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DEVOTED TO CIVIL ENGINEERING AND CONTRACTING

F. E. SCHMITT, *Editor*

Volume 106 NEW YORK, APRIL 23, 1931 Number 17

Work Begins

ON MONDAY of this week Secretary Wilbur's signature finally put the Boulder Dam contract into effect. This formal act sets in motion the vast and complex activities involved in carrying out the great enterprise. It is not altogether clear why several weeks were allowed to elapse after the contractors signed before the government executed the document, but the time has not been wholly lost. The contractor's forces have been on the ground, planning and doing preparatory work, so that the real work could be started expeditiously. Pioneers in Western construction, the men at the head of the Six Companies were true to their type; they had the faith and initiative to get preparatory work under way without waiting on formalities. The courage involved in advancing money for camp and road work on an unsigned contract, when a hitch meant no recourse, simply to permit a flying start typifies the spirit that will govern the building of Boulder Dam. Now, with the contract in effect, the slow assembling of men and materials can be speeded into intensive action and progressive acceleration.

Sharp Practice?

RECENT occurrences in contract lettings for federal buildings indicate the need of sharp questioning by government department heads of some of the practices of their contracting agents. A late example is the Boston post office contract, the circumstances of which are given in the news pages of this issue. In brief, by a process of changing specifications and asking for a first and then a second set of supplemental bids the contracting agents succeeded in chiseling down the bid prices to the figure they desired to obtain for the work. The procedure, not at all new in contracting, has come to be generally frowned upon by honest engineers and contractors as verging too much upon sharp practice to be countenanced in private business. When federal public-works practice descends to similar sharp methods it is high time that someone in Washington cited a few lessons on honest business and fair dealing to federal contracting agents.

Arbitration

ARBITRATION of contract differences is a sane, just and satisfactory method of settlement between engineer and contractor. Charles H. Stevens, chief engineer of the Philadelphia department of rapid transit, rendered a distinct service to both engineering and contracting by presenting the advantages of arbitration and its operation in a paper before the American Society of Civil Engineers last week at Norfolk. In the light of the successful application of arbitration in his own department, Mr. Stevens is well qualified to discuss the subject from a practical standpoint. As long as the present system of construction by contract exists, disputes and differences in interpreting specifications will result. Recourse to law through the courts is cumbersome, slow and expensive, and technicalities of law too often have precedence over considerations of equity. Arbitration has the advantage in both respects.

Practical Philanthropy

HOW Allegheny County has set about employing idle hands on public construction is a story of strong, constructive suggestion. The plan carried out is not one for making work, nor for doing work by primitive or uneconomical methods with a view to utilizing more manual labor. Nor does it subsidize the local governments by paying for part of the normal construction budget from private funds. The essence of the plan is to extend the community construction programs to cover work not immediately pressing but yet necessary and valuable; to select such work as is adapted to direct-labor construction without reducing or imperiling contract work; and to provide unemployed labor for this work at the cost of private contributors. Its effect is to replace both charity and waste-work methods by a practical philanthropy that increases employment, builds self-respect, improves business and serves the public with useful improvements. It does not increase the community's bill, but merely shifts part of the account from the bread-line budget to the construction payroll.

Better Rails

RAILS weighing 152 lb. per yard are being put into service by the Pennsylvania Railroad. Not only are they by far the heaviest rails yet rolled but also they mark a radical departure from present rails in the distribution of metal between head, web and base. The new rail is designed for axle loads of 100,000 lb. and speeds of 100 m.p.h., as against 80,000 lb. and 80 m.p.h. used in designing the Pennsylvania's 130-lb. rail. Development of ultra-heavy rail in practice was forecast two or three years ago when the American Railway Association's rail committee adopted a design for a 150-lb. rail, the high stresses built up in rails now in service having already made it apparent that stiffer rails and a higher quality of steel must come. The heavier section has come into being; better steel is in the offing, as indicated by the announcement made in March that a committee representing the A.R.E.A. and the rail manufacturers has been set up to study how rail steel may be improved. Such cooperation is a significant innovation in the rail field, where hitherto lack of cooperation has

been responsible for retarded progress. And therefore also the new Pennsylvania section is a milestone in rail history, since it came about as the result of joint study. It suggests that rail matters will make faster progress in the next decade or two than in the past.

The Structure Vindicated

THE board of review that investigated the crash of the British dirigible "R-101" has established that the cause was other than a structural failure. Leaky gas bags and consequent deficient buoyancy are given most weight in allotting the blame for the disaster. This is reassuring and gratifying, for the ship incorporated many entirely original structural assemblies that had been the subject of much criticism. Duralumin and alloy steels were also combined in a variety of new and untried ways. It is often claimed for structural analysis and design that they keep abreast of demand. In the case of an airship failure it is especially advantageous if this claim can be made good, for a study of the cause of the failure is then not complicated by structural questions. Successful development of the rigid airship requires that undivided attention be focused on its aerodynamic problems, for they are basic.

Earthquake Destruction

IF ONE were to set out to design buildings that would fall down in an earthquake the result would not differ widely from the design of the buildings in general use in Central America. That is the impression gathered from the description of Managua before the earthquake, given elsewhere in this issue, and from the comments of Colonel Sultan in his reports of the damage done. Heavy masonry walls laid up in weak mortar and having little or no foundation; flat arches; heavy overhanging cornices; and roofs of heavy tile supported on poorly and lightly built frames—such elements may be adequate for keeping out the elements but lack stability against earth movements. In defense of those who built Managua it should be said that they used the material they had at hand and made the most of their limited knowledge. Further, they built structures designed to meet their everyday problem of keeping out heat and moisture rather than to meet the unknown if not entirely unforeseen problem presented by earthquakes. The few well-constructed structures in Managua stood the earthquake well. This is especially true of the reinforced-concrete reservoir of the new water-supply system. That fact should bring encouragement to those faced with the task of rebuilding older cities thrown down by earthquakes.

Stabilizing Swamp Fills

BLASTING as a method of sinking highway fills through swamp muck is becoming a well-formulated process. A few years ago when explosives were used at all it was in a haphazard way, with only the general purpose of breaking up the surface mat so that the fill would penetrate and not float on the swamp. The Michigan highway engineers were perhaps the first to undertake blasting as a definite process of forming a subsurface embankment. Later the Minnesota highway department even more completely systematized procedure, as described in our issue of May 16, 1929, p. 788. An article in this issue explains the equally purposeful but wholly different blasting process being employed in roadbuilding in southern New Jersey. All these processes are alike in being methods of building, without excavation, a solid earth prism within soft material overlying firm bottom. As developed, the blasting process is most useful in swamps from five to twenty feet deep. Its main problem is to sink to solid bottom a fill which is not wedge-shaped with unsupported sides, or shaped like an inverted disk with entrapped muck at the middle. The solutions presented are not entirely convincing, but the least that they can claim is that a virtually new swamp embankment construction process has been developed to a remarkable degree of success and is being generally employed. Increased experience will make the control of the fill more certain.

Superstructure Participation

AFTER the Yadkin River bridge tests and the model studies of Wilson and Beggs the advantages of superstructure effect in concrete arch bridge design were painted in rather glowing terms by the investigators. The stiffening effect of deck participation was shown to reduce greatly the deformation of the rib; the reduction increased with the rigidity of the superstructure framework and the degree of continuity of the floor slab. Expansion joints in the floor were to be avoided under this premise. At the time that the advantages of superstructure participation were being extolled there were some who doubted the advisability of a too rigid rib. Now, model studies made during the design of the 412-ft. George Westinghouse arch at Pittsburgh reveal that while superstructure participation reduced the negative live load moment at the springing line about 40 per cent, translation of this advantage into fiber stress units resulted only in a reduction from 780 to 730 lb. per square inch. The saving in concrete and steel would be negligible. Apparently superstructure effect is not a subject that admits of generalization. It was advantageous on the Yadkin River bridge. It showed no economy at Pittsburgh. Perhaps some reason for this difference will be brought out by the model tests that are continuing at the University of Illinois. In the meantime too much reliance should not be placed on superstructure participation without careful examination of its effects in the individual case in question.

Pittsburgh's Bridges

FEW cities in the world can compete with Pittsburgh as a community of bridges. New York, Paris and London are justly famed for their river crossings, but none is possessed of a group of structures so various in type and stimulating in originality of design as the industrial region of which Pittsburgh is the center. At present four new bridges are under construction, three of which are described in this issue. The fourth, the new parallel-wire cable suspension bridge at South Tenth St., with a span of 1,500 ft., restores this type of structure to prominence in a region that once boasted many pioneer wire cable bridges, later overtaken by the march of progress. Among the half hundred large Pittsburgh bridges no preference as to type is discernible, although steel structures far outnumber those of concrete; the George Westinghouse bridge, with the longest span yet built in this country, will be a notable addition to the concrete group. Through trusses, deck trusses and cantilevers

are intermingled with plate girders and arches, in addition to the three chain-suspension bridges of the self-anchoring type. Steel arches receive notable additions in the spandrel-braced arch at McKees Rocks and the West End-North Side tied arch over the Ohio River, illustrations of the capacity of modern practice to carry out long-span steel arches as easily as simple cantilevers. Nor should the names of the engineers who have made bridge history at Pittsburgh be neglected in engrossed and admiring contemplation of their handiwork. Roebling, Lindenthal and their colleagues among the creators of the city's early great bridges have found worthy successors. The groups of engineers under Reppert and Covell, as well as the engineers of the railroads, are making bridge history of today no less distinguished than that of the past. To the student or practicing engineer Pittsburgh has long offered the broadest field of bridge study to be found in the world. This legacy, which the engineers of the present have inherited, is being further enhanced by each new undertaking.

Light on Bridge Clearances

INFORMATION from Washington that the army engineers are likely to demand a 200-ft. clearance height for the proposed 57th St. bridge over the Hudson River at New York raises anew the disquieting uncertainty that has long affected applications for bridges over major waterways. Such applications are now subject not to rule, for there is none that recognizes modern conditions, but to the arbitrary adjudication of the War Department. One result has been an absurdly inconsistent set of rulings, ranging in picturesque variety from the extreme of 135 ft. for the Delaware River bridge at Philadelphia to 193 ft. for the Columbia River bridge at Longview, Wash. As great inconsistency could be cited for inland streams, where a launch-load of picnickers may constitute the usual shipping.

Admittedly the army engineers have a difficult and probably unwelcome task in approving bridge clearances. This may temper censure but does not remove its justification. The fact remains that they have done little to seek help in formulating a policy consistent with modern conditions, which involve not only navigation requirements and the possible trend of ship design but the rights of land transport as well. The only solution appears to be recourse to a body of men informed on questions of shipping, highway transport and the economic rights of each, or else to appeal for help directly to Congress. Since the latter is to be avoided if possible, the news that the engineering economics division of the American Society of Civil Engineers, under the chairmanship of Ralph Budd, president of the Great Northern Railway, is to undertake a study of the bridge clearance question is particularly reassuring. A better board of experts than can be assembled by this division could not be found. Limits for horizontal and vertical bridge clearances should yield to an economic study. So should the question of whether a stream is navigable or not. Fundamentally the entire subject is one of economics with engineering considerations as a background.

To date the supposedly impartial adjudication of bridge clearances by the army engineers has succeeded only in being disappointingly arbitrary. With new light thrown on the problem by a board of experts, the army engineers' task should be made easier and the interests of everyone served more fairly.

Federal Control of Water Power

THE question of the ultimate nationalization of most of our undeveloped water-power resources is raised by the Federal Power Commission's decision to require the Appalachian Electric Power Co. to apply for a standard license for its proposed development on the New River in Virginia before starting work on the project. The water-power act gives the commission authority over the financing, design and operation of power plants on navigable streams, and further provides that the federal government may recapture such power plants at the end of fifty years, under the provisions of the license issued to the power company when it starts construction.

The New River is conceded by all to be non-navigable, but it is the principal tributary of the Kanawha, a navigable stream, which in turn is a tributary of the Ohio. Variations in the flow of the New River might conceivably affect the navigability of the Kanawha. Hence the power commission holds that the New River is "navigable waters within the definition of the act," and that therefore any power plant built upon it must come under the jurisdiction of the commission. On the other hand, the power company holds that the federal government's only interest in its project is in its effect upon the flow of the New River and that all the commission should require is an application for a permit covering only the control of the flow of the water as it affects navigation. The company holds that all other matters such as the financing of the project are outside of the jurisdiction of the federal commission and are purely matters of local state jurisdiction. Virginia, Kentucky, Tennessee and Arkansas support this view.

The point at issue is of great importance. If the commission's full jurisdiction extends only to power plants on the navigable sections of rivers which are actually navigable, then the number of power plants subject to recapture under the provisions of the federal power act is limited; but if its jurisdiction extends to the headwaters of navigable rivers and to the tributaries of navigable rivers, then practically all of the undeveloped power sites in the country come under the jurisdiction of the commission and may ultimately pass to the hands of the federal government. Virginia and some of her neighboring states view this possible development with considerable concern. They see in it not only a lessening of local control over power rates within their state boundaries but also a possible loss of a major source of revenue should the federal government take over all plants built under federal license.

The power commission's decision in the case in question without doubt will be contested and taken to the U. S. Supreme Court for a ruling as to what are navigable waters in law. A decision on that point will set a definite limit upon the power developments coming under the jurisdiction of the Federal Power Commission and possibly will say whether the commission's control over non-navigable tributaries (if it is found to have such control) is less complete than its control over navigable streams. A still broader question, raised recently by legal advisers to the State of New York, as to the constitutionality of the recapture provision of the federal power act, will remain open. Both questions are too important to be left long undecided. If the federal government's control over water-power development is less than the present federal water-power act indicates, then its extent should be clearly defined so that the states may apply effective control.

Three Notable New Bridges at Pittsburgh Described in Two Articles

I—McKees Rocks and West End Steel Arches

750-ft. spandrel-braced arch and 778-ft. tied arch span Ohio River and form important links in the new Sawmill Run and Ohio River boulevards

THREE distinct types of steel-arch bridges are under construction at the present time by Allegheny County, Pa. Two of the arches span the Ohio River at points about 2 miles apart, while the third type of arch is located in the long approach structure of one of the above bridges and spans the tracks of the Pittsburgh & Lake Erie Railroad. These new bridges will form unusually important traffic links in Pittsburgh's boulevard and street system. In addition, they present several interesting structural features.

As shown on the map, Fig. 1, the West End-North Side bridge is nearest to downtown Pittsburgh, which is situated in the triangle formed by the confluence of the Allegheny and Monongahela rivers. It is approximately 1 mile below the point of this triangle and crosses the Ohio with a tied arch of 778-ft. span. This bridge will form a link in a belt boulevard within the city limits but outside the business district. The part of this system on the south side of the river, known as Sawmill Run Boulevard, is partly completed and all under construction. The West End bridge and its connecting roads will form a convenient bypass for much traffic that must now pass through the congested city streets to reach the southern part of the county via the Liberty tunnels.

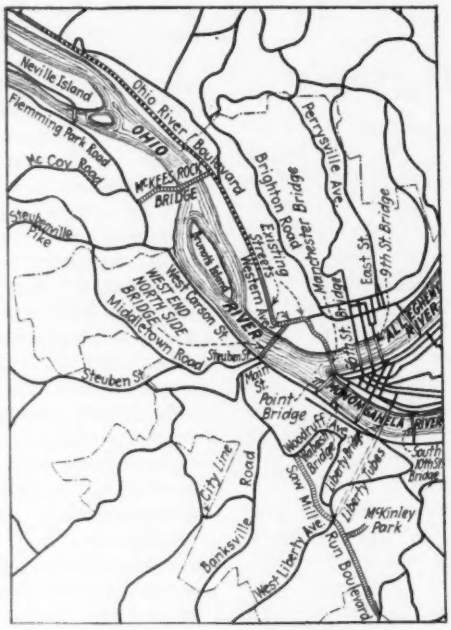


Fig. 1—Location of new Ohio River bridges at Pittsburgh

The McKees Rocks Bridge (*Engineering News-Record*, Aug. 1, 1929, p. 185) is about 2½ miles below the West End bridge and crosses the Ohio with a braced-spandrel arch of the Hell Gate type having a span of 750 ft. The approach to this crossing is 3,900 ft. in length and involves various types of structure. Maximum duplication of spans was desired, and as a result there are two 300-ft. crescent arches, eight deck-truss spans of 163½ ft., one deck truss of 197 ft. and one arch-deck span of 306 ft. The east approach consists of three arch-deck spans of 324 ft. This large structure will afford access for workmen now living on one side of the river and working on the other and will also serve as a tie to link together the county boulevards on each side of the Ohio—River Road on the left side and the new Ohio River Boulevard along the right bank. These two new bridges with their approaches represent an outlay of $10,000,000 and form the only two crossings of the Ohio between the Point Bridge at Pittsburgh and the bridge at Sewickley, 12 miles downstream.

All the bridges were designed under the standard specifications used by the Allegheny County Department of Public Works, under which medium carbon steel is required to have a tensile strength of 60,000-72,000 lb. per sq.in. and a minimum yield point of 35,000 lb. per sq.in. The basic working stress is 18,000 lb. per sq.in.

Crescent Arches

The crescent arches present several points of interest. It was necessary to use a through structure at their location to provide the necessary clearance over the Pittsburgh & Lake Erie Railroad tracks. The arch chords are on parabolic curves 12 ft. apart at the center, converging toward the ends, with the result that the two panels at each end have solid web sections. This arrangement caused some complication in the design, since the end panels were computed as for a ribbed arch while the remainder of the arch was figured as a truss. In the three-hinged condition under which the arch was erected the bottom chord carries approximately twice as much load as the top chord, but in the final two-hinged

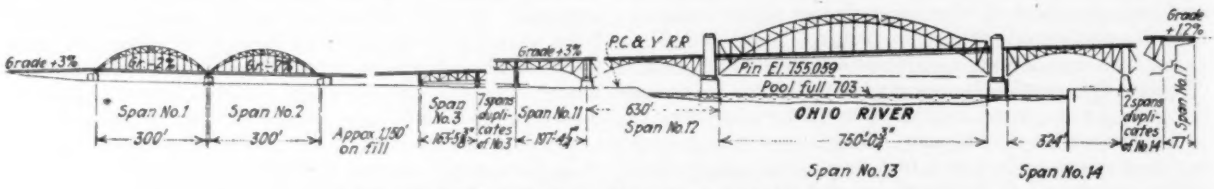


Fig. 2—McKees Rocks project, showing the crescent arches and the spandrel-braced arch over the river

Fig. 3—The 300-ft. crescent arches in the McKees Rocks approach

condition the load is practically equally divided between the upper and lower chords. Both the chords and the tie, a 12x24-in. box section, are of silicon steel, as are all gussets and splice material in these members. Web members of the arch are carbon steel. Bracing consists of a K-system in the plane of the top chords and vertical sway frames at each panel point. No bracing is used in the plane of the bottom chord. Hangers consist of two 6x1-in. bars.

An interesting departure is utilized at the rocker end of the arches, where cast-steel rockers are fitted with chrome-nickel iron bearing surfaces. This type of rocker, in which the lower bar is horizontal and the upper bar is finished to a specified radius (on this structure 2 ft.), has given good satisfaction on other county bridges also. It is also being used on the much longer West End arch with a radius of 3 ft. 7½ in.

The floor system consists of crossbeams with 68-in. webs, 21-in. CB roadway stringers on 6-ft. centers and 24-in. CB track stringers. The pavement slab, 8 in. thick at the crown (4 in. of concrete and 4 in. of surfacing) and 5½ in. thick at the edges, is carried on ⅜-in. buckle plates. The use of buckle plates eliminates the necessity for crossbracing in the floor and in addition is ideal for the installation of streetcar rails. Track details are unusually simple, the rails being placed in trough plates resting directly on the buckle plates. Also with this design of floor the break in continuity of the slab caused by the rails is not important, as it is in a slab unsupported by buckle plates.

All temperature movement in the floor of the two 300-ft. arches is taken up by a single cast-steel expansion dam located between the two spans. The design of the dam permits the covering plate to be supported on all four sides. This plate is relatively thin, ½ in., and this fact in conjunction with a slight depression in the entering plate provides a smooth-riding surface over the dam. Four inches of expansion in either direction is provided for.

McKees Rocks Arch

Span 13 of the McKees Rocks Bridge is the river crossing. It is a span of major proportions, being 750 ft. long center to center of pins. It is of the spandrel-braced type, 25 ft. deep at the crown and 106 ft. deep at the ends.

Considerable effort was expended to produce an artistically pleasing structure. In outline the curve of the upper chord is similar to that of the Hell Gate Bridge, flattening out near the ends. Only the lower chord intersects the roadway. Piers are granite faced, as are the piers of the flanking deck-arch spans and the pylons at the portals of the main arch. These pylons, of equal height, are 32x17 ft. in plan, hollow, and with two cross-walls. At one end of the bridge they extend to 60 ft. above the roadway, at the opposite end to 35 ft. This unfortunate difference in height above roadway is due

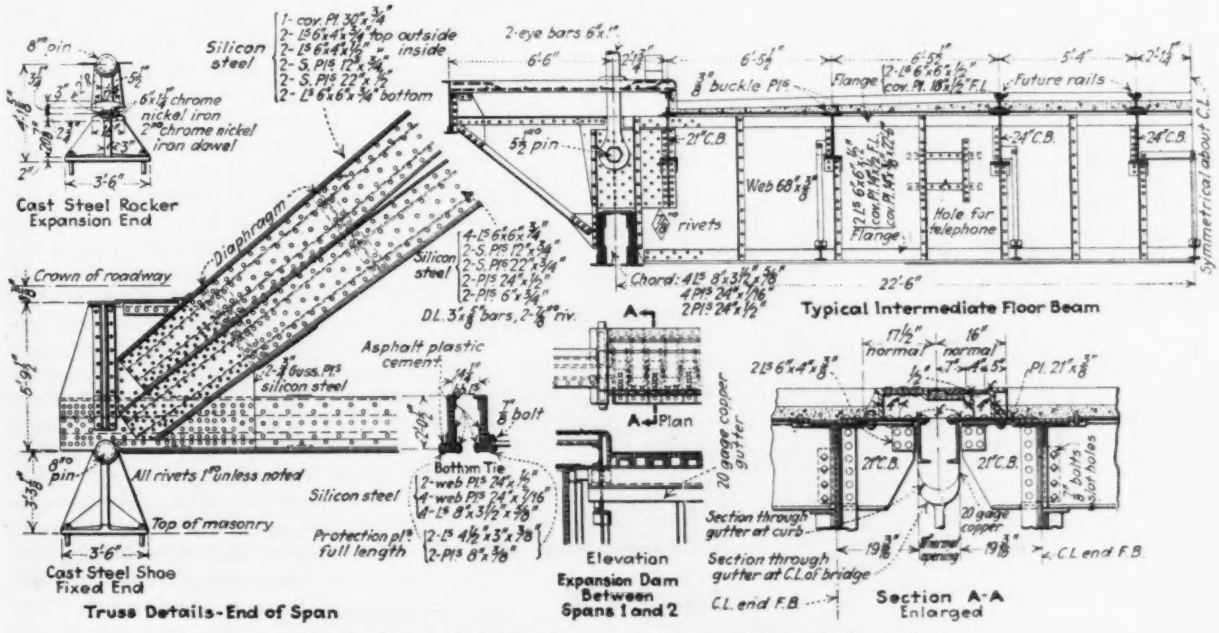


Fig. 4—Structural details of crescent arches in McKees Rocks project

A single expansion dam between the two arches provides for 600 ft. of bridge structure. Note also chrome-nickel iron rocker shoe. Similar expansion joints and rockers are used on 778-ft. span of West End bridge.

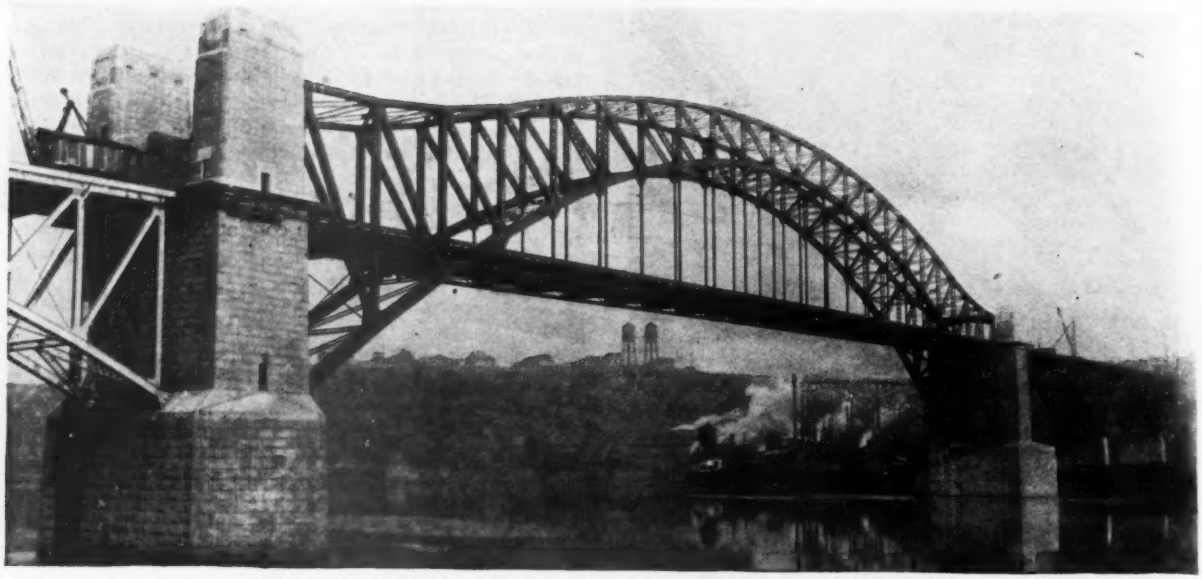


Fig. 5—McKees Rocks crossing of Ohio River, a 750-ft. spandrel-braced arch

to the 3 per cent grade on the roadway, which was rigidly fixed by existing conditions.

The bottom chord of the arch, with a maximum section of 251 sq.in., is a closed box section of silicon steel, tapered in depth from 54 in. at the pin to 34 in. at the crown. Except for the first two end panels, the top chord also utilizes silicon steel. It is of a constant depth of 24½ in. throughout its length, with a section area varying from 47 to 86 sq.in. Double-angle lacing is used top and bottom. Web members are of carbon or silicon steel as the stress conditions dictated. Four web members were changed from carbon, as designed, to silicon steel for erection purposes. A departure from usual practice is that of turning all angles on web members inward to secure a cleaner appearance.

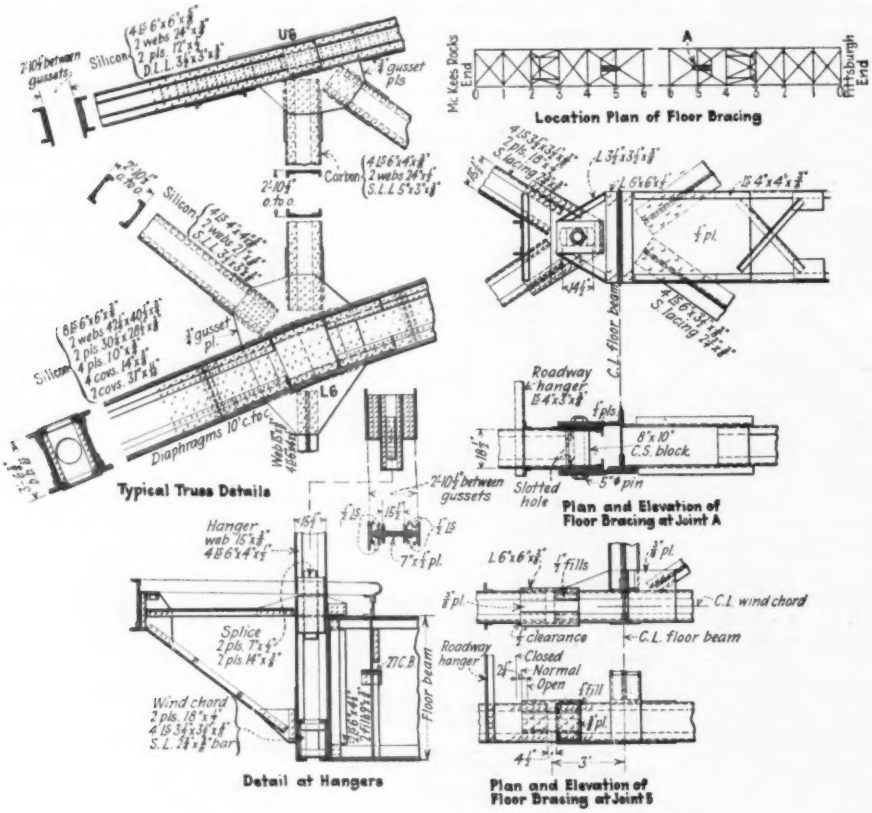


Fig. 6—Structural details of spandrel-braced arch, McKees Rocks project

Floor bracing over central portion is that of a simple span; at each end the bracing is that of a cantilever. Note detail at joints *A* and 5 where the two bracings connect. Pin at *A* takes wind shear but not moment, which is carried by a wind chord.

Lateral bracing of X-type is used in the plane of both upper and lower chords. The roadway, being on a 3 per cent grade, intersects the lower chord in panel 2-3 at one end and 3*A*-4*A* at the other. The portal bracing in these panels is similar, wind transfer across the unbraced gap being through the floor system. Thus at panel point 3 on one end and 4 on the opposite end a stiff hanger is utilized. Wind on the chord, say in panel 2-3, passes through the stiff hanger at 3 into the floor system of panel 2-3 and down the vertical at 2 into the lower chord. No sway-bracing is used except under the floor in the end panels.

The floor system consists of 68-in. plate girder beams, 27-in. CB roadway stringers and 30-in. CB track stringers. The floor bracing over the center portion of the span between panel points 5 and 5*A* is that of a simple span. Between panel points 5 and 2 on one end and 5 and 3 on the opposite end the floor is a

cantilever. At panel points 5 and 5*A* the cantilevers and the simple span are connected by a sliding block-and-pin arrangement, that picks up the wind shear but will not take moment. In the single-span portion the wind shear is taken by a buckle-plate floor, while a box-section wind chord in the plane of the bottom of the floor beams and

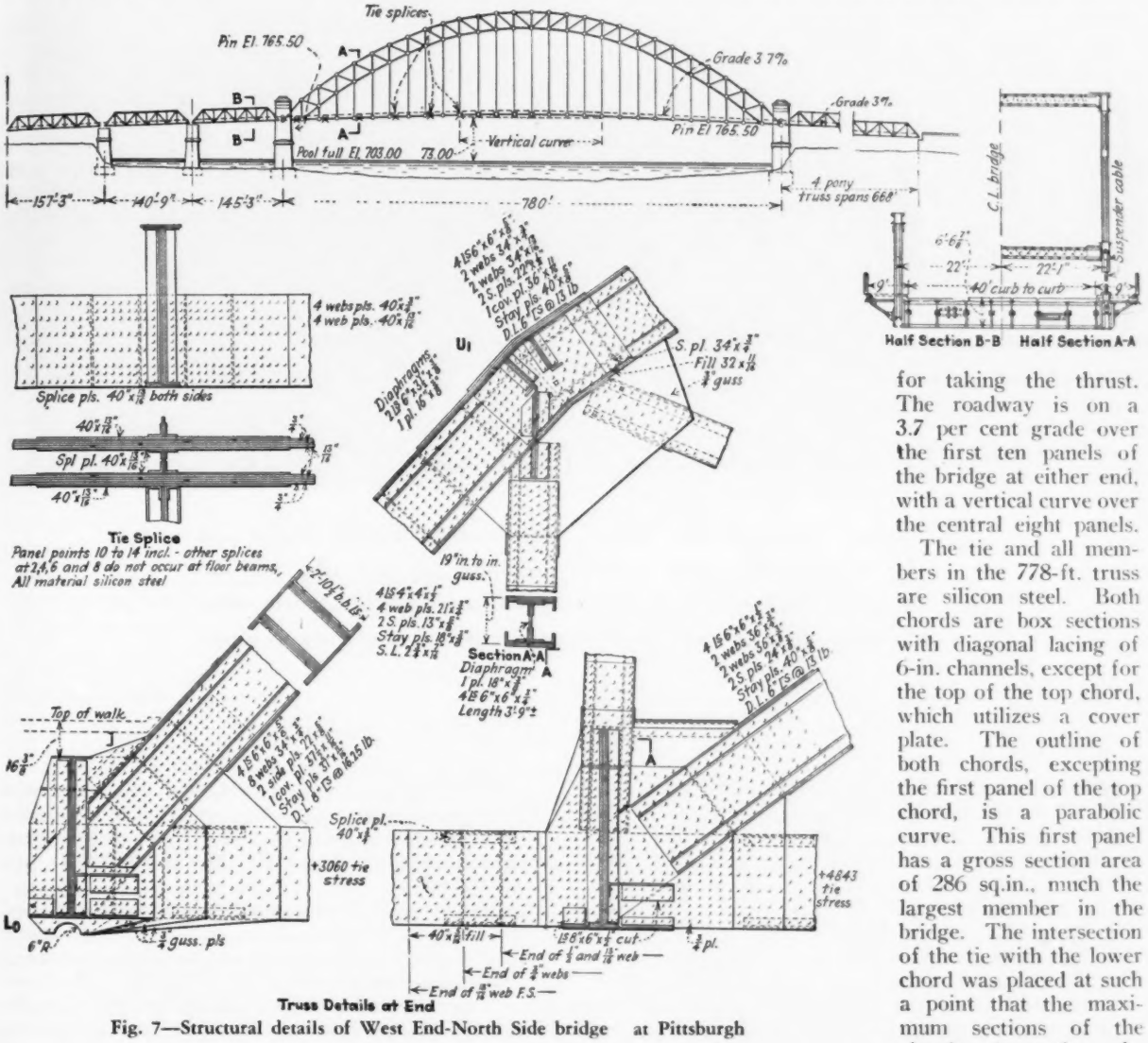


Fig. 7—Structural details of West End-North Side bridge at Pittsburgh

for taking the thrust. The roadway is on a 3.7 per cent grade over the first ten panels of the bridge at either end, with a vertical curve over the central eight panels.

The tie and all members in the 778-ft. truss are silicon steel. Both chords are box sections with diagonal lacing of 6-in. channels, except for the top of the top chord, which utilizes a cover plate. The outline of both chords, excepting the first panel of the top chord, is a parabolic curve. This first panel has a gross section area of 286 sq.in., much the largest member in the bridge. The intersection of the tie with the lower chord was placed at such a point that the maximum sections of the chords (excepting the first panel member of the top chord) are approximately the same, namely, 182 sq.in. for the top chord and 214 sq.in. for the bottom chord.

on the center line of the hangers is provided to take the moment. Hangers consist of a built-up section composed of a plate and four angles.

The McKees Rocks arch was erected as a cantilever, with anchorages provided by eyebar tiebacks connected to the adjoining deck-arch spans. After the first six panels from either end were erected and landed on steel-bent falsework, this portion acted as an anchor arm for the final cantilever arms which came to closure at the center of the span. The bridge was swung as a three-hinged arch and converted to a two-hinged arch under normal temperature and steel dead load.

West End Bridge

The use of an arch of the tied type was obligatory at the site of the West End-North Side bridge because of clearance requirements, which were 63½ ft. at the sides and 73 ft. over the channel. Also, the bridge is on so great a skew that the width of the piers was held down to 25 ft. in order to comply with channel width requirements. Such a narrow width of pier, coupled with the fact that the arch reaction was high up on the pier, precluded the use of a true arch and made a tie necessary

Lateral bracing is used in the planes of both the upper and lower chords. The truss is fixed at one end, with a rocker at the other. The use of a single rocker for such a long span is unusual. It is similar in design to that used on the crescent arches of the McKees Rocks approach, having chrome-nickel iron bearing faces designed for a unit pressure of 1,000 times the diameter per linear inch of rocker. Cast-steel rockers are usually designed for 600 times the diameter per linear inch. The vertical reaction carried by the rocker is 3,700,000 lb.

Hangers are single twisted wire ropes, consisting of six strands and an all-metallic independent wire-rope center. They were prestressed to obtain a minimum modulus of 20,000,000. The ropes are socketed at both

ends into steel hanger castings. The lower casting is connected to the floorbeams by 6¾-in. diameter pins. At the top a button socket bearing on a diaphragm is used. The maximum length of hanger is 135 ft. The maximum load over the vertical curve of the roadway is 325,000 lb., requiring a 4-in. diameter rope, the remainder of the rope being 3⅜ in. in diameter.

The tie consists of two parallel groups of silicon steel webs, eight plates in all, with a section area of 250 sq.in. Carbon steel diaphragms are used at 7-ft. intervals along the ties. No angles are used in the ties, since it was easier to get the required section by plates. Also, angles would complicate floor-beam connections and require an extra splice. The splice of the tie as made up required only one splice plate either side of each group of plates. Within the splice, which is 9 ft. long, the web plates are lapped, joints being broken at intervals of approximately 2 ft. The maximum stress in the tie (next to the last panel) is 4,838,000 lb.

The floor system is similar to that on the McKees Rocks Bridge, consisting of floor beams with 69-in. webs, 24-in. CB roadway stringers and 27-in. CB track stringers. On account of the long span the buckle plates could not be considered as floor bracing. This was designed as a K-system from end to end of the span. Provision for 5 in. of expansion in either direction is made at the end of the bridge and at three other joints to prevent participating stresses.

The West End arch is being erected by the cantilever method with the aid of steel bents. The trusses will be swung as three-hinged arches by lowering the jacks at panel points 8, and conversion to the two-hinged condition will be made under the steel dead load.

The McKees Rocks Bridge is being erected by the Fort Pitt Bridge Works, and the West End Bridge by the American Bridge Co. The substructure for the McKees Rocks Bridge was built by the Dravo Contracting Co. and for the West End Bridge by The Foundation Co. All county work is carried on under the direction of Norman F. Brown, director, department of public works, and all bridge work under the direction of V. R. Covell, chief engineer of bridges.

II—A Concrete Arch of 460-ft. Span

George Westinghouse Bridge over Turtle Creek Valley on Lincoln Highway with a 42-ft. roadway on two ribs will be longest American concrete arch—Model studies used to determine stiffening effect of superstructure and location of expansion joints

By G. S. RICHARDSON
Assistant Engineer of Bridge Design, Allegheny County, Pa.

THE LARGEST concrete bridge project yet planned by Allegheny County is under way on the Lincoln Highway just east of Pittsburgh. It involves 1,500 ft. of high-level structure over the Turtle Creek Valley, bypassing (overhead) the towns of East Pittsburgh and Turtle Creek, and includes five reinforced-concrete arches, one of which is 460 ft. long between pier centers, the longest span yet built in this country. The west approach connects with Ardmore Boulevard, leading directly into Wilkinsburg, the first borough east of Pittsburgh. The structure is a joint state and county project and will eliminate the present route through the valley, which is characterized by heavy grades, bad alignment, narrow roadways and congested local traffic. The bridge is just south of the plant of the Westinghouse Electric & Manufacturing Co. and will be known as the George Westinghouse Bridge.

The selected location for the new highway came as the result of joint state and county studies of several routes. Up to the time of the final location, all estimates for the bridge were based on a steel structure. Afterward careful estimates were made for three different layouts as follows:

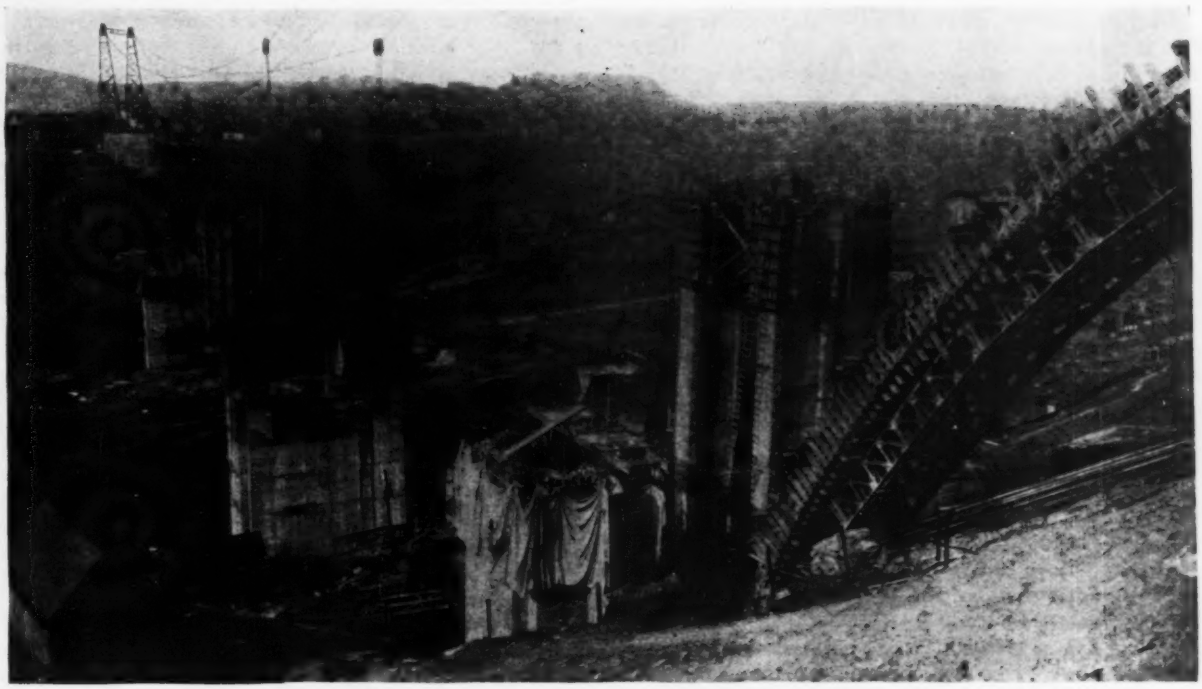
1. A deck cantilever steel bridge with a main span of 900 ft. and anchor arms of 325 ft. each. The estimate was based on using silicon steel for the trusses and a light-weight aggregate for the reinforced-concrete roadway and sidewalk slabs.
2. A concrete bridge, as described in this article.
3. A deck cantilever steel bridge of five spans with 450-ft. central span, using ordinary steel and concrete.

The estimated physical costs for these three layouts were respectively: $1,640,000.00, $1,540,000.00 and $1,320,000.00.

Largely because of its superior architectural merit and with some consideration given to lower maintenance costs, the concrete design was adopted. The bridge is now under contract at a bid of $1,483,000.00. This compares with an estimated cost of $1,453,000.00, after deducting $87,000.00 from the above estimate as the cost for paving, a decorative handrailing and lighting, which items are not included in the present contract.

General Layout

The general arrangement of spans was fixed within close limits by local conditions, which indicated a five-span layout. The location of the west abutment was determined by a fault in the underlying rock, which made it necessary to place this abutment farther to the west than otherwise would have been done. With these limiting conditions the layout was made as symmetrical as possible about the central span. A further condition which had to be met at the main piers was the relative location of the skewbacks for the short side-span arches and for the large main-span arch in such positions that the resultant thrust lines would not produce excessive overturning moments on the foundations of these piers. With the spans and rises determined for all arch ribs



Pier construction on the high-level Westinghouse Bridge at East Pittsburgh

the axes were fixed with regard to economy, as it was thought that the curves thus obtained were also satisfactory in appearance. The deck has four lanes for vehicular traffic with 42 ft. between curbs and two sidewalks, each 7 ft. wide. The roadway descends on a 4 per cent grade from east to west.

Pier Design

All piers and abutments are founded on sound rock. The deepest foundation occurs at pier No. 2, where the rock lies about 85 ft. below the surface. At this point and at pier No. 3 the contract specified that provision should be made for sealing the foundations by the pneumatic caisson process. As it developed during construction, it was not necessary to use air, the piers being sunk as open caissons unwatered with little pumping, and the foundations poured in the dry.

Typical sections for pier No. 2 are shown in one of the accompanying illustrations. Above the skewback for the side arch the construction is cellular with light reinforced walls forming the shaft. Below this skewback the pier is solid except for a central well about 15 ft. wide transverse to the bridge and about 30 ft. long. The two solid masses thus formed are tied together by outside transverse reinforced walls. All walls have a minimum thickness of 18 in. at the roadway level, with inside surfaces vertical and exposed surfaces battered $\frac{3}{16}$ in. in 12 in. This gives a maximum wall thickness at the top of foundation of about 5 ft. For architectural effect column pilasters will be carried above the arch ribs, and these are utilized to stiffen the walls. Similar reasons led to the adoption of wide pilasters on the ends of the piers. The design for all piers is similar.

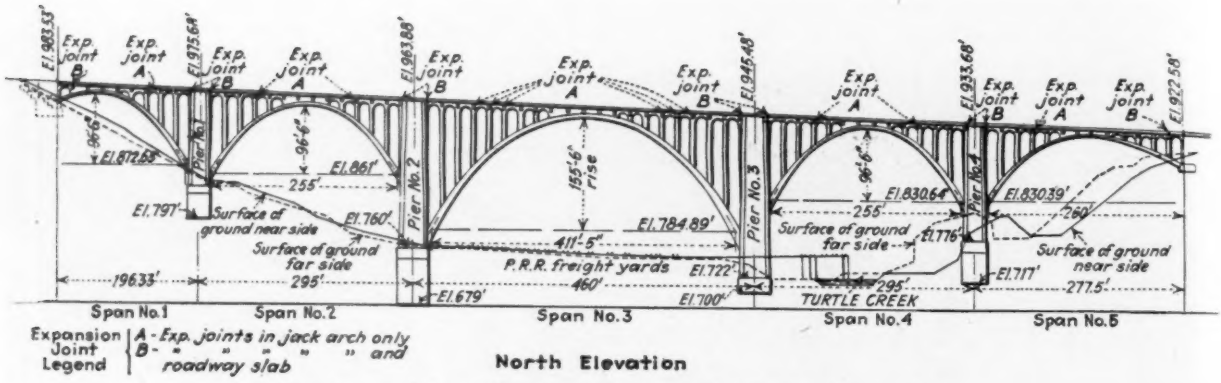
Rib Design

It was decided at the outset to use two ribs for each span. This leads to economy of formwork in construction and a minimum of uncertainty in stress distribution. From a study of previous county designs a width of 14 ft. was established for the main-span ribs, and this same width was carried throughout all spans. With this width approximate figures indicated that for the main span a depth of 5 ft. at the crown and 10 ft. at the springing would give ample section; too deep ribs were avoided as giving high temperature and rib-shortening stresses. In a great many American arches the ratio of crown depth to span is approximately 1:50, while in this arch the ratio was made less than 1:80. The ratio of rib depth at springing to that at the crown is dependent largely upon the ratio of rise to span. In this case, with a high rise of 158 ft. and a span at springing of 411.52 ft., the ratio is nearly 0.4, so that the depth at the springing line was made twice that at the crown.

All the ribs are designed for a maximum working stress of 800 lb. per sq.in. under combined dead load, live and impact load, rib-shortening and temperature stresses, this working stress being based on a minimum 2,000-lb. concrete. For a loaded length of more than 100 ft. the county uses a live load consisting of a uniform load over the whole length with a concentration applied at the point which will produce maximum moment. For the arch ribs of this bridge a uniform load of 975 lb. per ft. and a concentration of 102,000 lb. were used per rib. These figures include 25 per cent for impact. Temperature stresses are calculated for a drop of 40 deg. and a rise of 20 deg. F.

A model study of the main span was made with the Beggs deformeter to determine the stiffening effect of the superstructure. This study showed that the negative live-load moment at the springing line would not exceed 60 per cent of the moment calculated for the bare rib. When this moment is reduced to terms of fiber stress the reduction is only from 780 to 730 lb.

All arch ribs will be poured in sections with keys 4 ft. long between adjacent sections. On the main span only three keys will be used, but the two closing sections will



Span layout of George Westinghouse Bridge—Details of main-span piers

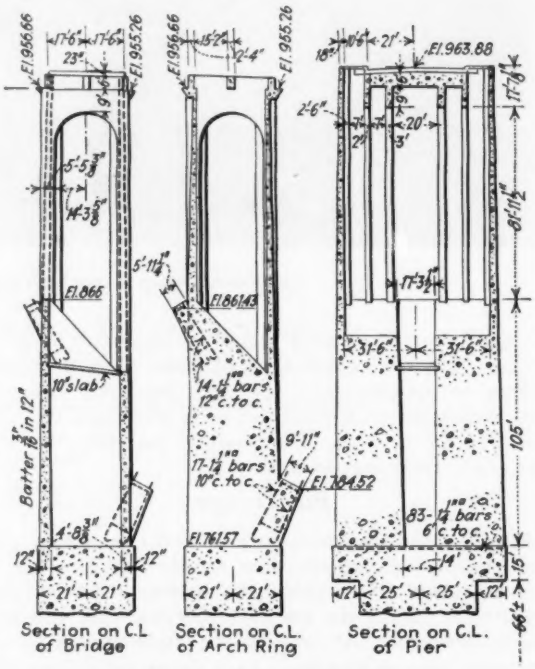
be short and act as keys. The keys serve two purposes. During construction, when the rib is supported on steel-arch centering, the keys are necessary at points of large angular changes in the centering. Also, by pouring the ribs in sections and allowing some time to elapse before pouring the closing keys, shrinkage stresses are relieved.

All main reinforcing will be 1¼-in. square rods. Each rib of the main span will have a total of 34 bars divided equally between top and bottom and extending through the length of the rib; all other ribs have a total of 28 bars. In the keys these bars will be lapped and welded on the top for a minimum length of 12 in. This welded length will be increased if tests indicate this is necessary to develop the full strength of the bar. This welding will not be done until at least seven days have elapsed after the pouring of adjacent sections of concrete. At intermediate joints the bars will be spliced by lapping a sufficient distance to develop the bars in bond, and the splices will be staggered in such manner that half the bars are continuous through each joint. The bars will be held in position by light structural-steel cross-frames spaced at intervals of about 15 ft., the bars being clamped to these frames by hook bolts. Throughout the rib for the top bars and for the bottom bars at any point where tension may be developed ½-in. diameter stirrups spaced 3 ft. c. to c. are provided.

As unsymmetrical ribs are rather unusual, particular mention of these may be of interest. Experience indicates that about the same values for dead- and live-load moments and thrusts may be expected at the upper springing as for a corresponding point located symmetrically with respect to the high point of the rib. The rib-shortening and temperature stresses tend to be higher, since the effective rise of the arch is determined by a distance measured normal to the sloping line between springing points and not by the distance from a horizontal line through the lower springing to the high point of the rib. Tested in this manner most unsymmetrical arches are found to be very flat.

Column Design

The columns over each rib consist of two shafts, each having a width transverse to the bridge of 2 ft. except for the end columns on the main span, in which this dimension is 2½ ft. The dimension longitudinally with the bridge varies from a maximum of 4½ ft. for the longest columns to a minimum of 2½ ft. for the shortest. This gives a maximum ratio of length to width of about 30. The two shafts of each column will be tied transversely by a heavy diaphragm immediately under the floor beam, and in the case of the longer columns



Details of main-span piers

with intermediate diaphragms spaced a maximum distance apart of 30 ft. clear. In cross-section each bent forms a four-legged rigid frame with adequate lateral stiffness to tie the two arch ribs together. The center to center of columns was established with the idea of balancing as nearly as possible the dead loads from the floor beams and projecting sidewalk brackets. A distance of 32 ft. was used. Models were made of typical column bents and studied to determine the distribution of load to the column shafts. It was found difficult to make a model representative of the structure and yet flexible enough to distort without buckling. However, fairly satisfactory results were obtained by weighting down the models heavily. By this means enough of the buckling could be prevented so that the sum of the four shaft reactions measured about 95 per cent of the load. The results indicated that a maximum of 55 per cent of the total column load for the longest columns would be carried by the inner shaft. On one shorter column without diaphragms that was investigated, about 60 per cent of the total column load was carried by the inner shaft. The short columns have sufficient excess section to provide for this load.

The stringers are continuous beams with sufficient strength for two T's to carry a line of 18-ton truck wheels. An allowance of 4 in. over the 5½-in. slab has been made for roadway surfacing. The curb will be of sawed granite 10-in. high, and further protection will be provided by a secondary concrete curb set back 7 in. from the first and raised 12 in. higher.

Expansion Joints

The original contract plans called for expansion joints spaced ordinarily every fourth panel. Subsequent to the call for bids model studies were completed, the results of which indicated that joints were not required except at the ends of the spans. The plans have been accordingly revised. A model of the main span with four intermediate and two end joints showed that under a uniform change of temperature the movement of any floor point due to column rotation was approximately equal to its movement due to linear expansion of the floor. As a result of these combined movements two of the intermediate joints closed slightly under a change of temperature, the other two opened slightly, and the movements at the ends of the span were practically the same as they would have been if the intermediate joints had been omitted. The model showed the influence of the unsymmetrical columns in that a greater movement occurred over the longer columns.

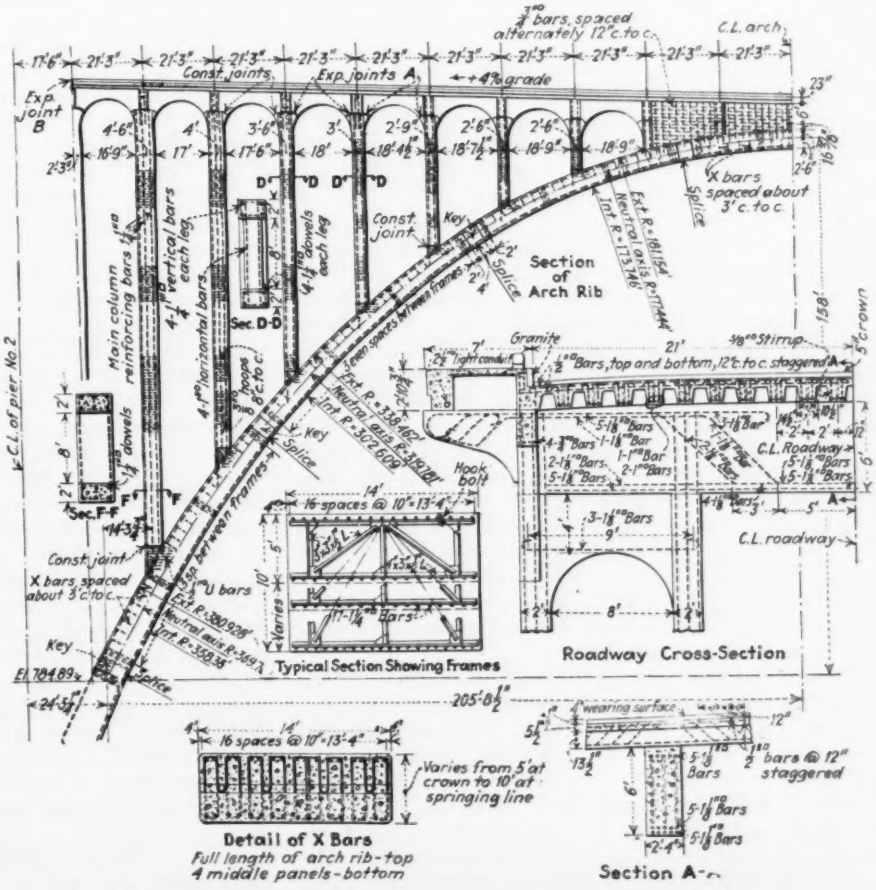
In a study of a second model without intermediate joints, angular changes at the top and bottom of several columns were measured and sufficient data observed to calculate bending stresses in the superstructure by the slope-deflection formulas. The maximum stresses for a 40 deg. temperature change figured 120 lb. per sq.in. for the fascia girder, 75 lb. for the T-stringers and 100 lb. for the columns. Necessary assumptions as to the composite action of the floor system make the results rather uncertain, but the magnitudes indicated are within reasonable limits of accuracy for uniform temperature changes. The maximum values for the floor system occur at the ends of the span.

The effect of varying temperatures throughout the structure cannot be easily determined by model studies. Experience with the arches in this district has indicated that the largest stresses occur in the floor system in the vicinity of the quarter points of the spans, and these may result from unequal temperatures. In any case, it is certain that an angular change at any point will cause the greatest bending stresses in the deep jack arches. The T-stringers are so shallow that they have great flexibility, and the columns are comparatively flexible. As a precautionary measure to prevent cracks in the jack arches, partial hinges will be created in the vicinity of the quarter-point columns by placing expansion joints in the jack arches only. These will be constructed by separating the jack arch from the column by a strip of premolded joint filler 1 in. thick and supporting the arch on the column with sliding plates. This permits the joint to close or open somewhat at the bottom and relieves the high bending stresses that otherwise might occur in the jack arches.

The contract was awarded to the Booth & Flinn Co., of Pittsburgh, and the construction is being carried out under the supervision of George Hockensmith, general superintendent. The principal quantities involved are as follows:

Excavation for foundations, cu.yd.	34,000
Concrete in foundations of piers, cu.yd.	20,000
Concrete above foundations in piers, cu.yd.	30,000
Concrete not included above, cu.yd.	22,000
Steel reinforcing and dowels, lb.	3,500,000

The project as a whole was initiated by the highway department of Pennsylvania, Samuel Eckels, chief engineer. The general design for the bridge was suggested by the department of public works of Allegheny County. This department prepared the design contract plans and assumes responsibility for supervision of construction. Norman F. Brown is director of the department, and V. R. Covell is chief engineer of the bureau of bridges. The cost of the entire project will ultimately be divided equally between the state of Pennsylvania and Allegheny County.



Details of the 460-ft. main span of the George Westinghouse Bridge

Percolation Beds Provide Disposal of Sewage-Plant Effluent

By CLYDE POTTS
Consulting Engineer, New York

Natural sands of Long Island permit percolation at maximum rate of 10 m.g.d. per acre—Glass-covered sludge-drying beds have high efficiency

BECAUSE OF the residential character of Rockville Center, a rapidly growing community of nearly 14,000 on Long Island, the treatment of its sewage requires processes yielding a high-grade effluent and accompanied by the least amount of objectionable odors. The recently completed treatment plant is of the activated-sludge type and is characterized by heated sludge-digestion tanks, glass-covered sludge-drying beds and percolation beds for effluent disposal. The gas produced by the digestion is utilized to operate the compressors for the aeration tanks and to drive an electric generator to help out at times of peak-load. A high efficiency is obtained from the glass-covered drying beds, about four times as great as that of open units. The plant capacity is two million gallons per day.

Preliminary settling tanks, providing one hour's detention, remove the grosser solids from the flowing sewage. The solids go to the sludge-digestion tank, and the effluent passes to the aeration tanks, where air is added at a rate of from 1 to 1½ cu.ft. per gallon of sewage. Final settling in tanks follows aeration; the sludge is removed from these tanks mechanically, and a portion is returned to the influent of the aeration tanks, the excess going to the sludge-digestion tanks. The effluent from the aeration tanks is clear, odorless and non-putrescible, and under ordinary circumstances could be discharged into any suitable stream of flowing water. As no such stream is available, percolating beds were adopted; the effluent is discharged upon these beds at the rate of 400,000 gal. per acre per day. These beds were constructed by stripping off the top soil and exposing the natural sand prevailing throughout this portion of Long Island. The top soil as stripped off was used to construct dikes around the six percolating beds. Tests made on portions of the percolating beds showed that they had the power to absorb activated-sludge effluent at the rate of 10 m.g.d. per acre.

The sludge from both the preliminary and final settling tanks is discharged into eight covered digestion tanks, each of 7,600-cu.ft. capacity. Their roofs are depressed below the water level to prevent the formation of a sewage crust on the surface. It has been found by experience that these crusts form above the surface of the liquid and become dry and not subject to decomposition to the same extent as when kept submerged. The tanks are provided with gas collectors in which the gases of decomposition are collected through a system of piping carried to a gas holder of 5,000-cu.ft. capacity. The gas, about 70 per cent of which is methane, is used to operate the air compressor and generator in the blower house. Indications are that sufficient gas will be secured to operate the plant from six to eight hours daily. This can be used during the peak load on the electric plant and a lower rate obtained thereby. The gas is also used in the laboratory where analyses of the raw sewage and sewage effluents are made.

As a result of the digestion, the sewage solids are reduced to an inert, odorless mass. This is withdrawn and discharged on to four glass-covered sand beds, 79x263 ft. over all. The glass cover, a large greenhouse, increases the efficiency of the sludge beds about 400 per cent, as it permits sludge to be withdrawn, regardless of rains in the summer or the cold weather of the winter, and enables substantially four times as many cleanings to be carried out per year as with open beds.

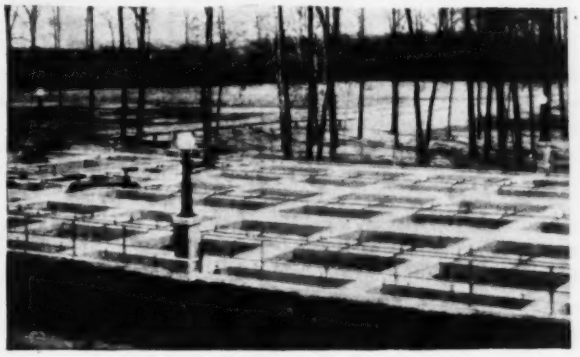
Attention was paid in the design of the settling tanks to distribution of flow, to obtain the maximum utilization of the tank capacity. The force main to the plant branches into six outlets, each with a gate valve, allowing two outlets to each unit of the tank. These outlets discharge into troughs, in the bottom of which are five 8-in. orifices for each unit, equipped with cast-iron lift valves. The orifices direct the flow downward to adjustable deflecting plates. The effluent passes through a submerged slot, which extends practically the whole width of the tank. This arrangement provides distribution of the flow across its entire width and also serves to equalize the rate of flow by retarding the peak flows in the preliminary tanks.

The final settling tanks are of the vertical-flow type. Each tank has two inlet troughs, and each inlet trough has two 18-in. drop pipes, located so that each is at the center of a quarter of the tank area. A flange is hung on the bottom of each drop pipe to deflect the flow horizontally across the area of the tank. There are four evenly spaced outlet troughs provided with multiple V-notch weirs.

Porous tubes of alundum are used for air distribution instead of porous plates. It was only recently that such tubes suitable for this use and at a reasonable cost have been available. They can be made into convenient units which are easy to assemble and may be readily

Progress in Sewage Treatment

How Rapidly the art of sewage treatment is progressing is indicated by the fact that a plant similar to the Rockville Center plant was designed in 1917 for Jersey City and its construction was prevented by an injunction granted by the Chancery Court. The injunction was based on the novelty of the design, which included preliminary settling tanks and sludge digestion, sludge heating, utilization of sludge gases, and other essential features of the Rockville Center project. Those features which were novel in 1917 are now well established in practice and find sound exemplification in the recently completed plant.



Aeration tanks equipped with detachable diffuser units

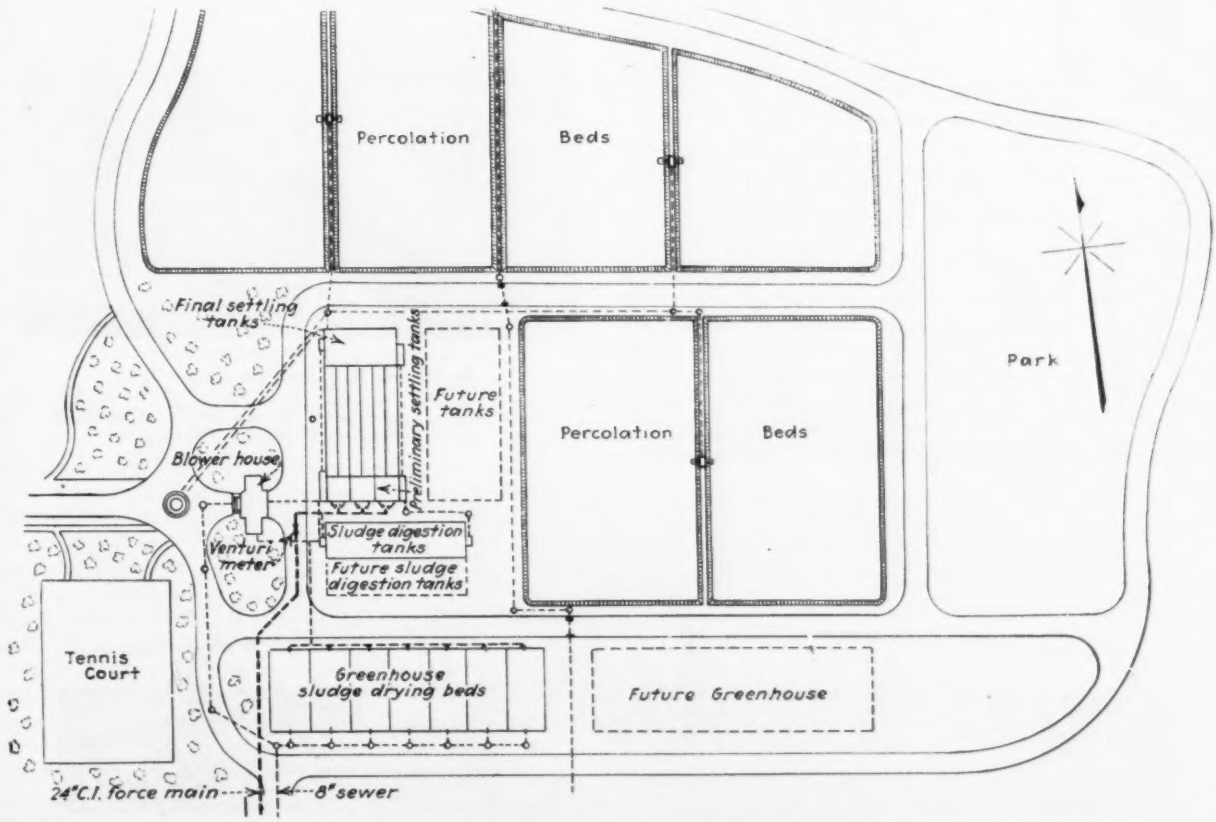
Sludge-digestion tanks covered with earth

removed at any time for inspection or repair. They have the further advantage of permitting the point of application of air to be at a shallower depth than would be required with plates at the bottom of the tank. With a direct pressure blower of the type used, the power consumed is practically in direct proportion to the pressure, so that a material saving in power is effected by the reduction in static pressure on the diffusers. The tubes appear to work well, with uniform distribution of air.

With a view to giving the maximum flexibility of operation, gates are provided which permit a great variety of flow combinations. One or more units may be used for the re-aeration of sludge, and any unit may be cut out of service. Any tank may be drained, and sewage may be pumped from any tank to the sludge-digestion tanks or to the sludge-drying beds.

The sludge-digestion tanks are covered with earth for heat insulation. Each tank has a sludge inlet pipe and a displaced-liquid outlet pipe. These are movable, so that elevation of the points of inlet or outlet may be changed. There is also a sludge outlet at the bottom of each tank. The piping is cross-connected, so that sludge may be pumped out of one tank, treated with lime and returned to the same tank or to any other unit. The flow lines in the digestion tanks may be kept at the same elevation as the hydraulic grade in the preliminary tanks. It is planned to keep the tanks full at all times except for gas that may collect at the top. If sludge is withdrawn, the liquid elevation will be kept up with flow taken from the bottoms of the preliminary settling tank.

An important feature in the digestion of sludge is the necessity of treating the displaced liquid. The liquid will have a high oxygen demand; a high rate of discharge into the settling tanks might seriously affect their opera-



Layout of Rockville Center sewage-treatment plant

Fig. 4—Percolation beds for disposal of plant effluent

tion. Accordingly, the sludge-digestion tanks are arranged so that the liquid may be displaced slowly. In cold weather they are heated by a hot-water circulating system. A small centrifugal pump circulates the flow in this system, which is connected to a gas water heater and to the water jackets of the gas engine, and is to be connected later to water jackets on the exhaust pipe, utilizing waste heat.

Considerable attention was paid to the layout of the plant in order to make it as attractive as possible. The blower house is modernistic in motif. It faces a street which leads to the plant and presents an attractive appearance. Roads and drives are laid out throughout the plant. It is not uncommon to see a hundred or more citizens at a time walking around the structures.

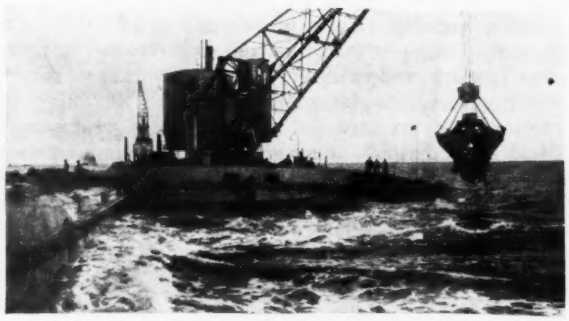
Construction began May 1, 1929, and the plant was completed and put in use on Nov. 16, 1929. The contract for the building and plant was awarded to Joseph L. Sigretto and Sons on their bid of $483,000. The contract for building 72 miles of sewers was awarded to Connor Brothers on their bid of $887,865.60.

F. H. Guerin was the resident engineer in charge of the work. The design of the sewage-treatment works was under the direction of Weston Gavett. Abraham Slavin designed the architectural features and many of the details of the sewage-treatment works.

Reclamation Work in the Netherlands

THE reclamation work in the Netherlands, by which a large tract of land is being made available for cultivation, has now reached the point where the first polder (a tract of land reclaimed from the sea by dikes) has been pumped dry and is available for planting. This the Wiering Lake polder, is the smallest of the four polders proposed in the reclamation of the Zuider Zee. It has an area of 50,000 acres, 9 per cent of the total area of the four proposed polders, which will have an area of 550,000 acres, or 7 per cent of the present area of the Netherlands.

On July 29, 1929, the gap in the dike around Wiering Lake was filled and thus a start was made with the Wiering Lake polder. In the spring of 1930 the draining of the sea water was started by means of two pumping stations having a total capacity of 486,000 gal. per minute under normal conditions. At the same time drainage canals were dug by floating dredges. Recently the dry land has started to become available for cultivation. The accompanying illustrations show how some of the work was done. One of them shows the extent of the tidal current through the gap in the dike surrounding Wiering Lake, three days before the gap was closed. Another illustration shows a bottom-dump barge dropping boulder clay in front of the gap, two days before it was closed, thus throttling off the tidal flow and facilitating the closing of the dam. A third illustration shows the digging of a drainage canal with a self-propelling floating dredge. In all, 750 miles of such digging will be performed.



Reclaiming land from the Zuider Zee

Above—Depositing boulder clay to close off the last gap in the Wiering Lake dike. Below—Bottom-dump barge used in building the dike.

Drainage canal being dug with a self-propelling floating dredge

Settling Swamp Fills by Blasting

Methods used to stabilize highway embankments in southern New Jersey

By J. A. WILLIAMS
Division Construction Engineer,
New Jersey State Highway Department, Camden, N. J.

SLOW SETTLEMENT of floating highway fills, a comparatively minor matter with low-type roads, is a condition which cannot be tolerated under a rigid pavement slab. New Jersey highway engineers have for several years been experimenting with a method of dropping either old or new fills to firm bottom through swamp muck by the use of explosives. The procedure followed was described by Mr. Williams in a paper presented before the last convention of the American Road Builders Association and later repeated at the recent meeting of the Association of Highway Officials of the North Atlantic States. His paper forms the basis of the present article.—EDITOR.

TIDAL MARSHES of semi-plastic mud, usually about 30 ft. in depth, are common in the coastal plain of south New Jersey, while the higher lands in this area contain a large percentage of sand which makes excellent fill material. Early roads crossed the marshes by floating fills which, because of constant slow settlement, required maintenance. Lately the need for rigid pavements on many roads traversing these swamps has made it essential to obtain solid fills carried down to the solid bottom beneath the mud.

Dynamite has been found very effective in bringing about this condition. The explosive has two functions: first, to push out the mud from beneath the fill; second, to offset any bridging effect and aid in the compaction of the fill material. The method herewith described accomplishes these two purposes so well that permanent pavements can be placed on new fills immediately. Although the same general principles are followed, the procedure is subject to minor variations with different job conditions. It is, therefore, best described by considering separately the treatment of new fills over undisturbed meadow and existing floating fills that require enlargement and stabilization.

Settling Embankment for a New Road

Successive steps followed in placing a new 50-ft. fill over undisturbed meadow or swamp are illustrated in Fig. 1. The initial blast is for the purpose of disintegrating the crust of turf that overlies the mud. It consists of 1-lb. charges of 50 per cent straight nitroglycerin dynamite loaded in a checkerboard arrangement in lines 2 ft. apart in each direction and is fired by the propagation method. From 50 to 100 ft. of roadway is handled in one blast. Breaking the turf is necessary to stop the bridging effect and to permit the fill to penetrate as far as possible into the mud under its own weight. No attempt is made to throw out the material; the purpose of the blast is merely to break it up. After this has been accomplished three cases of 60 per cent straight gelatin dynamite are placed on the exposed surface. The two outside cases, about 40 ft. apart, are adjacent to the previously completed section, with a third case on the center line some 25 ft. in advance of the first two. Blasting cap leads from each case are wound loosely around a heavy iron wire, 8 to 10 gage, which is fastened firmly to the case. This wire is cut to the proper length, as explained later, and the loose end is wound around a piece of board. Fill material is then dumped on the section, covering the dynamite cases and forcing them down into the mud. To determine the amount of fill the contractor is required to make soundings at 50-ft. intervals with a piece of ¾-in. pipe, and on the basis of these soundings the depth to be placed is calculated. Should his soundings show that there is 30 ft. of mud below the grade of the meadow and the plan call for a finished grade 10 ft. above the surface, this would require 40 ft. of fill. Allowing 10 per cent for compaction, each iron wire would be cut to a length of 44 ft., measured from the case of dynamite to the end. One dump man is placed in charge of these wires to see that they are not destroyed by trucks while the material is being placed. As the fill settles and is built up the wires are unwound from the boards until the end is reached, indicating that the total depth of fill required is in place.

With the three-point loading just described each fill section is triangular in shape, extending about 25 ft. ahead of the toe of the previously settled section and covered by about 25 ft. of new fill ahead. This gives the

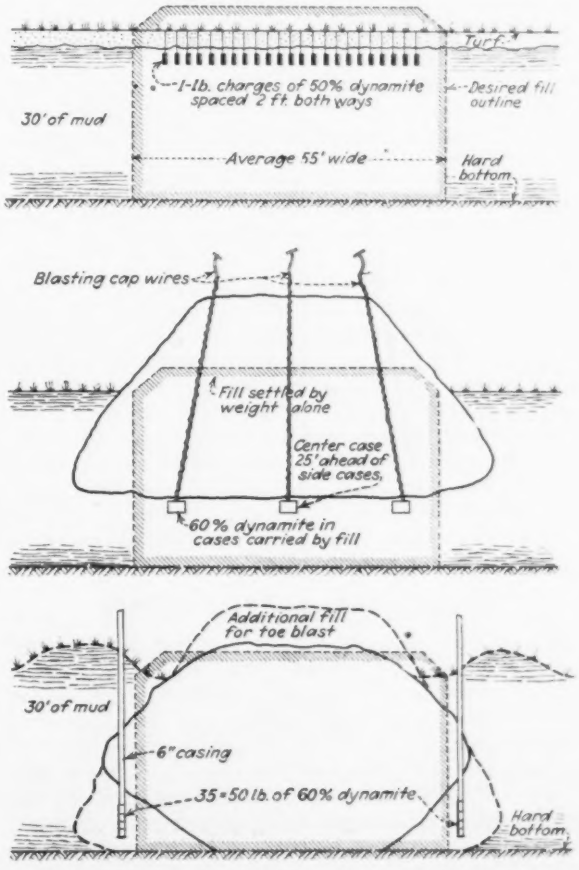

Turf
1-lb. charges of 50% dynamite spaced 2 ft. both ways
Desired fill outline
30' of mud
Average 55' wide
Hard bottom
Blasting cap wires
Fill settled by weight alone
Center case 25' ahead of side cases
60% dynamite in cases carried by fill
Additional fill for toe blast
30' of mud
6" casing
35 - 50 lb. of 60% dynamite
Hard bottom

Fig. 1—Steps in settling a new highway fill by blasting

Top: removing crust of turf. Middle: fill material, settling under its own weight, carries down dynamite cases previously placed. Bottom: additional shots widening toes.

embankment a wedge action that tends to split the mud and force it to either side. The front width of the fill is about 10 ft., the dumping width of a truck, and the pointed shape is maintained by bulldozers that push the material out after each explosion. As a section of the fill goes down a pile of mud is pushed up ahead. Sometimes this will re-settle before time for the next shot; if not, a small charge of dynamite is used to blow it away.

Experiments tried with the dynamite at various depths indicate that best results are obtained with the explosive close to the bottom of the new material.

After the shot has been set off the contractor is again required to make soundings; and at points where the fill is not down to solid bottom it is settled by charges of varying amounts up to 50 lb., loaded through 6-in. casings. This action is particularly important along the edges of the fill. When this system was first tried it was assumed that if the bottom of the fill were down to hard bottom for the same width as the top of the road, the fill would be stable. However, after two or three years it was noticed that there was a tendency for settlement at the sides, resulting in a decided increase in the crown of the road. Investigation showed that the meadow material is unstable chemically, and the change in pressure seemed to increase the chemical action, resulting in side settlement. Accordingly, it is now believed essential to have an adequate width of fill on hard bottom, which is the reason for placing the side loads to attain this condition.

Method for Wider Roadways

For embankments with widths in excess of 50 ft. the procedure already described has been followed, and then the sides extended laterally by the three-point system of loading. The amount of explosive necessary at the sides is greater because the mud is already compacted and is harder to move. Usually the loads are doubled, although in some cases as much as 150 lb. of 60 per cent straight gelatin dynamite on 30-ft. centers has been necessary. Both sides of the road are shot at once, usually in 50-ft. sections.

Although the method has not been actually tried in the field, it is believed that fills more than 50 ft. wide could be placed by using a modification of the three-point method, with either five or seven charges in a wedge arrangement. In this case it would be necessary to use heavier charges because of the additional covering.

Many of the swamp crossings involve, at some point along the embankment, the construction of a bridge. This requires no change in procedure; the fill is made and settled with dynamite as though no bridge were to be built; and later, when the embankment has been completed, the site is re-excavated.

Settling Existing Fills Under Traffic

A modification of the method just described is used when it is necessary to rebuild an existing road over the same alignment, settling the existing floating fill, and at the same time maintaining traffic. The first step is to break the bridging effect between the meadow mat and the existing fill by setting off 5-lb. charges of 50 per cent straight nitroglycerin dynamite along each side of the existing fill, these charges being placed at a depth of approximately 5 ft. in holes put down with a pole or bar. Both sides are fired simultaneously by the propagation method, the operation being, in effect, the blasting of two ditches 300 to 400 ft. long. It was found by experience that when this blast is set off a crack usually appears along the center of the road, allowing mud to seep through. Accordingly, before the shot is fired new material is piled along the center of the roadway to a depth of 3 or 4 ft., leaving room on each side for traffic. Immediately after the blast a bulldozer spreads the piled-up fill over the roadway.

The new fill is then built up by the end-dumping method until total amount of dirt required is in place, the depth of material is determined in the same way as before, although a board is used as an anchor for the wire in place of the case of dynamite. Usually a 100-ft. section of roadway is treated at a time. A portable piledriver is then used to put down three lines of 6-in. staggered holes spaced 50 ft. apart, one row along the

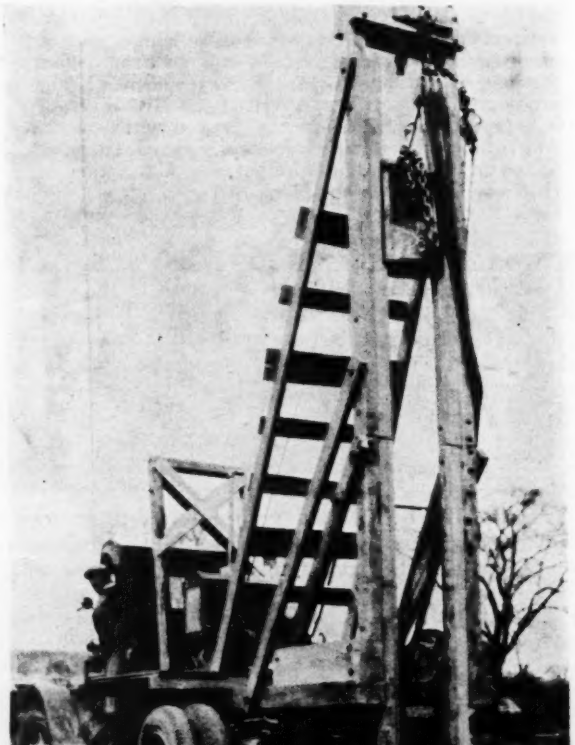


Fig. 2—Truck-mounted piledriver used to drive casing

center of the roadway and one near each side. A 6-in. casing is used for the holes, which are loaded with 60 per cent straight gelatin dynamite, usually 100 lb. to each charge. A large amount of explosive is necessary to break up the bridging effect of the old fill.

After the blast, soundings are taken to make sure that settlement is complete; if the embankment is not down to solid bottom, the operation must be repeated.

Salvaging a Damaged Concrete Pavement

A frequent condition in southern New Jersey is the settlement and displacement of a rigid pavement that has been laid over an alignment that has held up under traffic for years with some type of semi-permanent pavement under periodic maintenance. In one typical case a two-lane concrete pavement was laid on an old 30-ft. road that had been used for nearly 100 years with no thought

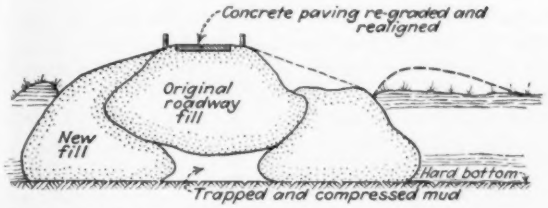


Fig. 3—Stabilizing a floating fill, preserving original pavement

of foundation trouble. The concrete opened up in the center, settled at the sides and suffered some lateral displacement. In this case the problem was presented of reinforcing the fill, widening it and bringing the pavement to line and grade with as little damage as possible to the hard surface.

Here, again, the first step was to blast a ditch along each side. The purpose was not to throw out material but to liquify the mud to as near hard bottom as possible. In many instances it was necessary to reblast several times in order to do this thoroughly. With the material liquified the next step was to dump new fill material into the ditch and push it down with a bulldozer. The amount of sand that could be pushed under the original roadway fill was surprising. When one side of the fill was completed the operation was repeated on the other, trapping and compressing a certain amount of mud under the center of the old fill, as shown in Fig. 3.

The embankment having been stabilized, it was next necessary to bring back the old pavement to line and grade. After closing one lane to traffic, each corner of each individual slab was marked to show how much it should be moved and raised to attain its final position. The amount of fill necessary under each slab was figured, and the required volume of sand was piled on each. Four or five slabs along one side of the road were then jacked up, using three 5-ton jacks under the outer edge of each. These jacks were raised high enough so that when center blocks were placed and the jacks lowered the slabs would balance at the right grade. The sand piled on each slab was then forced underneath by poles and pushers. This was continued progressively until one side of the road had been brought to grade, after which traffic was rerouted and the other side handled in a similar manner.

Large hooks, cables and turnbuckles extending across the pavement were used to move the individual slabs transversely to proper alignment. In order to control the motion the slab to be shifted was jacked up to reduce the surface friction, so that when the turnbuckles were tightened this slab moved while its mate stayed in place. Traffic, of course, was routed along the fixed slabs, passing over the cables without interrupting the work. In this manner all the slabs were moved into line, one lane at a time. This resetting operation was finished more than three years ago, and since that time has shown no objectionable movement or breakage.

Equipment

Many different methods were tried for making the holes used in loading dynamite. The most successful was the portable piledriver mounted on the chassis of a 3½-ton truck, shown in Fig. 2. This was equipped with 14-ft. leads and an 800-lb. hammer, operated by a single-drum hoisting engine with a niggerhead. The first operation was to drive a 6-in. casing with a mandrel point attached down to the required depth. This was pulled out, leaving a hole into which the open casing could readily be placed. When driving the casing a 12-in. square piece of roofing tin was bent around the bottom of the loading pipe to keep out the dirt. It is surprising how much resistance this small piece of tin has; in many cases where only fill material was encountered no mandrel was needed, the loading pipe being driven down with only the tin over the bottom. Once the casing was placed, the dynamite was loaded, using cartridges 16 in. long and 5 in. in diameter, which slid readily to the bottom of the pipe. The explosive was held down with a wooden tamp pole while the casing was pulled, an operation facilitated by the water used for tamping. Pulling of both spandrel and casing was accomplished by a five-part tackle attached to the niggerhead. No difficulty was experienced, due to the short time the casing stayed in the ground and also to the fact that the vibration of the engine and the action of the truck springs put a constant tension on the pulling rope.

Although the piledriving leads on this outfit, illustrated in Fig. 2, were only 14 ft. long, there was no trouble in driving a 30-ft. casing. This was done by attaching a chain to the hammer with the other end hooked into the top of the pipe to be driven.

Resurvey of Disputed State Line

RECOVERING or reestablishing old land lines to settle property disputes is a troublesome task calling for extreme patience and care, with intuition as an important factor in locating or determining ancient corners and markings long obliterated. An important example of work of this kind is the resurvey of the Wisconsin-Michigan state line, which had been under dispute for several years. This was done in 1929 under a joint commission of the two states, which appointed Earl G. Harrington, of the U. S. General Land Office, as its engineer. The requirement was to find and monument the line established in 1847 by William A. Burt between the Montreal River and the Brule River, about 64 miles long. The following description of this work is condensed from a paper by Charles A. Halbert, chief state engineer of Wisconsin, in the 1930 *Proceedings* of the Engineering Society of Wisconsin:

This survey required about eight months, a continuous line being run from Brule Lake. The party consisted of three ax men, a head chainman and an instrument man. In general, two new bearing trees were marked, one in Michigan and one in Wisconsin, and the original bearing trees, if in existence, were described in the notes. The true bearing between monuments was determined by astronomical observations, and the distances between corners were measured with a steel tape. Slope angles were read when necessary, and the true horizontal distances between monuments were obtained. Direct and reverse readings were made of all angles in triangulating across the lakes which were intersected by the boundary line. On long triangulations the distances obtained across the lake were checked by independent triangulations. The steel tape used was divided in chains and links to facilitate comparison with the Burt notes.

The initial point of the west end of the boundary was reestablished from the stumps of two of the original bearing trees and from a small circular mound of stone about 6 in. below the surface of the ground. The initial point of the east end was reestablished from what appears to be the first bearing tree set by Burt on the

meander line of the lake. The marking includes the date, Burt's name and the initial mile numeral.

In all, about 70 per cent of the original ¼-mile and 1-mile corners were found, generally by locating one or both of the original bearing trees. In a few places rock monuments were found, and in one or two instances Mr. Harrington believes he found a part of the original stake located below the groundwater line in cedar swamps. Where the original bearing tree is still living the Burt markings were found 2 to 6 in. from the surface, depending on the species and whether the tree had favorable growing conditions. In some instances the outer chip taken off shows the markings in negative as plainly as the original markings.

As the line passes through some of the most inaccessible portions of the state, packing in the concrete monuments—sometimes a distance of 5 miles—was a laborious task. These monuments, 30 in. long, 8 in. square at base and 6 in. at top, weighed about 90 lb. and were awkward objects to carry. In fact, old packers who will ordinarily carry 100 to 150 lb. would not attempt to pack them, probably because of the risk of injury in falling with a pack of this nature. The markers were carried by two men on an improvised stretcher.

The bearing between the reestablished Burt ¼-mile monuments and the bearing of the original line has a maximum variation of about ½ deg., and in general the difference in bearing is but a few minutes. The length of the half-miles between these monuments has an overrun of 10 to 15 ft.

Filters and Pumping Station Connected by Tight Concrete Conduit

Sixty-inch bell-and-spigot pipe with six-inch shell leaks under test only 150 gal. per minute per inch diameter

By WILLIAM C. MABEE
Chief Engineer, Indianapolis Water Co., Indianapolis, Ind.

FOLLOWING the recent completion of a second large conduit connecting the White River filters of the Indianapolis Water Co. to the Riverside pumping station, careful leakage tests were made indicating an extremely tight line. The results were the more interesting in that the conduit passes under Fall Creek and was laid in water-bearing sand and gravel dewatered with well points.

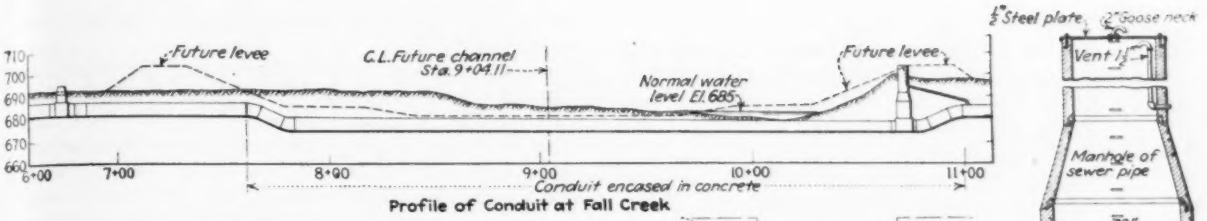
Indianapolis derives its water supply principally from surface sources supplemented by deep wells. The White River filter plant supplies 42 m.g.d., but a development to 76 m.g.d. is contemplated. A 48-in. monolithic reinforced-concrete conduit built in 1903 conveys the effluent from the original filter plant to the pumping plant a mile away.

The old and new conduits traverse different routes from their terminals but are brought together in a bypass structure at the pumping station to permit flexibility in the distribution to either of two pump-suction wells, connected to the underground storage-water reservoir system. The separate routing permits the isolation of either conduit for inspection or repair.

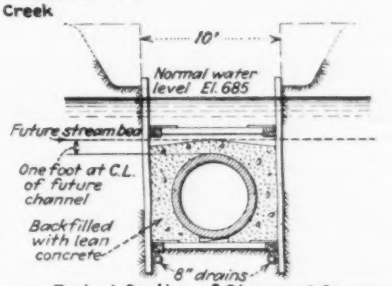
Manholes were provided at convenient intervals to permit access for inspection. Combination manholes and

Laying bell-and-spigot concrete conduit

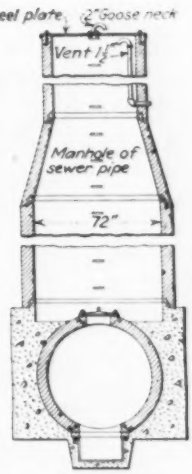
Gravel formation made the trench very wet. Note gates for poured joints and pointing "snake" back of workman on pipe. Four concrete supporting blocks are set to grade prior to lowering pipe to place.



Profile of Conduit at Fall Creek



Typical Section of Stream at Crossing



Manhole

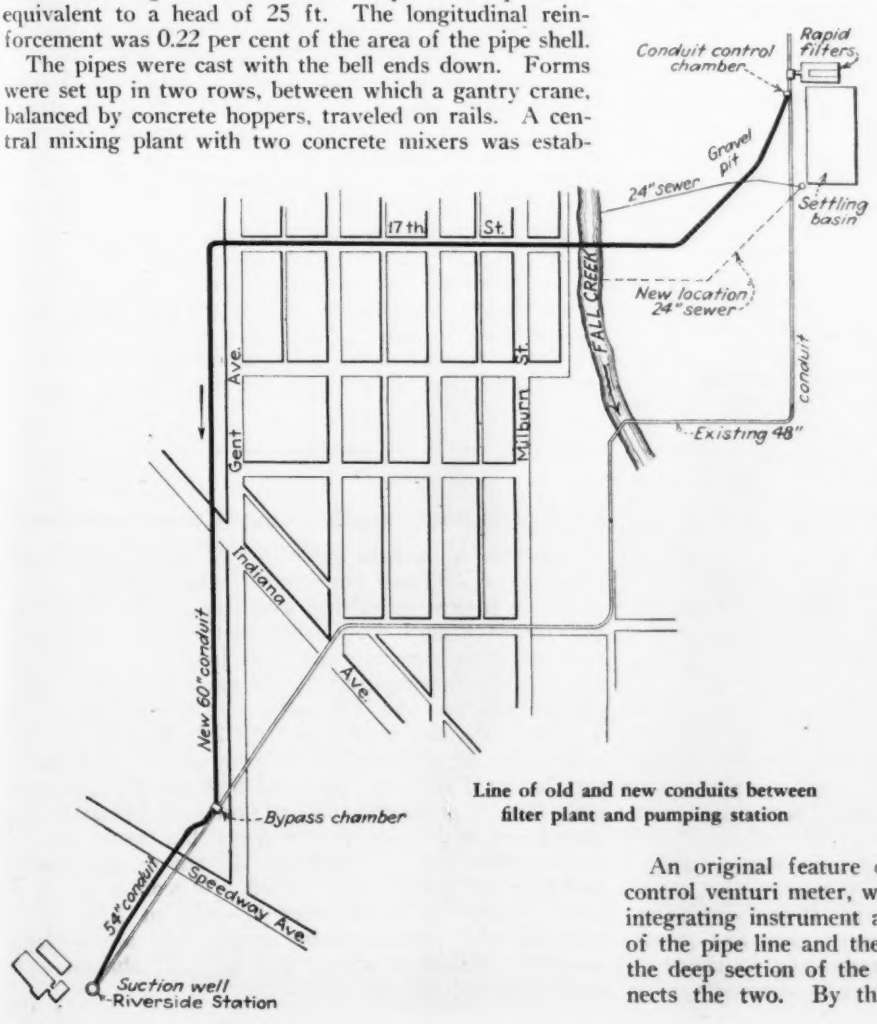
Fall Creek crossing and manhole

sumps were also provided at the inverted siphon under Fall Creek and at the lower end of the pipe to facilitate cleaning and dewatering. The manholes extend to the surface and are capped with steel covers bolted to the concrete walls. Additional cast-iron bolted covers were placed over the openings in the pipe, thereby conserving the velocity head at these points.

The new supplemental line is a precast reinforced-concrete pipe laid to hydraulic grade and provides connections for the ultimate development of additional filters at one end and storage reservoirs near the pumping station at the other end. It consists of 4,400 ft. of 60-in. and 700 ft. of 54-in. copper-bell type pipe in 12½-ft. lengths, 6 in. thick, molded in steel forms. A flanged sheet-copper cylinder was cast in the pipe bell to provide for expansion and contraction to take up inequalities of grade in the ditch. Joints were made with "leadite." Circumferential reinforcement consisted of two cages of steel bars designed for an internal hydrostatic pressure equivalent to a head of 25 ft. The longitudinal reinforcement was 0.22 per cent of the area of the pipe shell.

The pipes were cast with the bell ends down. Forms were set up in two rows, between which a gantry crane, balanced by concrete hoppers, traveled on rails. A central mixing plant with two concrete mixers was established at one end of the pipe yard. Curing was accomplished by covering the newly stripped pipe with a canvas sack onto which water from a garden hose was sprayed for several days. Concrete was a 1 : 1½ : 2½ mixture.

The groundwater table was unusually high due to heavy rains during the time the trench was open. Quicksand was encountered under Fall Creek, necessitating piles driven 24 ft. to reach a bearing. The concrete incasement entirely surrounding the pipe with at least 1 ft. cover in the streambed was also reinforced. Through the deep section in the station grounds a well-point system was installed thus avoiding the use of sheet-piling, which had been necessary up to the time the well points were installed.



Line of old and new conduits between filter plant and pumping station

Upon completion a leakage test was conducted with the pipe under a head of 25 ft. for a period of six hours. The leakage tolerance of the contract for the 4,372.4 ft. of 60-in. pipe amounted to 9,937 gal. per day. The actual measured leakage was 7,516 gal., equivalent to 151 gal. per inch diameter per mile of pipe per day. Comparable results were obtained on the short section of 54-in. conduit. To insure accuracy the gates at either end of the system were closed during the test, which was made by feeding water into the pipe through a calibrated ⅝-in. meter. Gate leakage was measured in buckets, and the proper allowance was made.

An original feature of the installation is a remote-control venturi meter, with the indicating, recording and integrating instrument actuated by a motor at one end of the pipe line and the meter tube at the other end in the deep section of the conduit. A five-wire cable connects the two. By this means the filter operator is

enabled to know the discharge at all times and may control the entry of filtered water into the conduit by remote-control gates. Recent flow tests on quantity of discharge indicate that the assumed pipe coefficient (Hazen and Williams' formula) of 140 is exceeded, a coefficient of 150 being determined from observations.

Specifications were made up and bids taken on cast iron, steel and reinforced concrete for this pipe. The contract was carried out by Price Brothers Co., Dayton, low bidder for the copper-bell type reinforced-concrete pipe.

The engineering studies, design and supervision of the conduit construction were made by the engineering staff of the Indianapolis Water Co., for which H. S. Morse is manager, W. C. Mabee chief engineer, Harry E. Jordan filtration engineer, and Homer Rupard designing engineer.

Men Return to Work on Public Projects Under Pittsburgh Plan

Allegheny County Emergency Association pays wages while municipalities provide materials, equipment and skilled labor

By NATHAN B. JACOBS
Of Morris Knowles, Inc., Engineers, Pittsburgh, Pa.

THE PITTSBURGH department of public works recently completed the first improvement project, undertaken in conjunction with the Allegheny County Emergency Association, to offer work on public projects to unemployed. Under this cooperative plan the association pays the wages of the men whom it furnishes, while public funds provide materials, equipment, supervision and skilled labor. Beside the completed project, 76 others have been started, and 19 more have had funds provided; 2,800 men are at work. The appropriations for labor on the 95 projects by the association are $465,693. The work extends throughout Allegheny County; in addition to work in Pittsburgh, three projects have been undertaken in East Pittsburgh, two in Turtle Creek, three in Etna, seven in Swissvale, six in Shaler township, two in Wilmerding, six in Port Vue, five in Edgewood, three in McKeesport, one in Avalon, three in Springdale. These are included in the above total of 76.

Practically all of the projects undertaken are paving or sewer improvements. The largest appropriation for labor for any single project is $48,000, the smallest $800. The municipality's share of the project, for supervision, materials and equipment, is about 40 per cent of the labor cost.

The Allegheny County Emergency Association was formed Feb. 6, 1931, by civic and industrial leaders of Allegheny County after the city had discontinued relief work among 10,000 families. The cost of this relief work had been $100,000 per month. It was decided to attempt to raise $3,000,000 by contributions and to use this money to pay the wages of men to be furnished to Pittsburgh and other municipalities in the county for work on public projects. On April 9 the total subscriptions were $816,416.

From the point of view of the municipality it was an opportunity to cooperate in the relief of unemployment without undue financial burden and to carry out augmented improvement programs with no more than normal budgets. From the point of view of the unemployed it found a source of employment for men in proportion to their need; it aimed to eliminate the dole and to attract needy persons who might otherwise have suffered rather than apply for charity. The projects do not extend to the class of work usually done by contract, and the contractor's business is not imperiled.

The association's list of unemployed came from three sources: 3,300 names from the relief lists of the city, representing the heads of 10,000 families that had been receiving aid; 2,717 names from social agencies; 4,487 names from direct application to the association after it had been organized and had established five stations in the city for unemployment registration and application for work; 1,835 names from similar stations in outside boroughs and towns. Thus the association has 12,339 men available for work, of whom 2,800 are at present placed on the 76 projects under construction.

The application for employment is in essence a questionnaire that enables the association to determine the degree of need of the applicant. It contains a rating as to dependability from the last regular employer of the applicant. Requisitions for labor for specified projects are made to the association by the engineering department of the municipality undertaking the work and are accompanied by a description and an estimate. When these are approved by a committee of the association, made up of men experienced in engineering and contracting (funds are appropriated and men assigned. The efficiency of the labor is said to approximate that of city-hired crews in the same class of work. For the one project so far completed the actual cost of the labor was $708, as against the engineers' estimate of $800. The wages are $4 per day for eight hours' work. In order to afford work to as many men as possible, two crews are assigned to each project, the crews working in alternate three-day shifts. Compensation insurance covering the laborers is carried by the municipality.

How Wisconsin Is Reducing Cross-Connections

Last year Wisconsin eliminated 51 cross-connections between potable and non-potable water supplies. In the drive toward complying with state board of health code requirements L. F. Warrick, state sanitary engineer, reports 205 inspections made. On Jan. 1, 1929 (twelve municipalities not reporting), 173 connections with non-potable supplies and 107 with potable supplies were in force. Permits were issued for 23 connections with non-potable supplies and 36 for connection with potable supplies. Of the 104 remaining with non-potable supplies for fire-protection, 68 are protected essentially in accordance with code requirements but await minor modifications and reinspections; 32 are unsatisfactory and four are yet to be inspected. Wisconsin has 293 municipalities or communities (population 1,787,000) provided with potable public supplies; 32 are surface supplies; 64 shallow springs and wells, 17 shallow and deep wells and 180 deep wells.

Transportation Is Theme at Meeting of Civil Engineers

Highway, surveying and mapping, waterways and sanitary divisions also hold technical sessions at spring meeting in Norfolk, Va.

Engineering News-Record Staff Report

WATER, rail, air and highway transport problems provided the theme for the spring meeting of the American Society of Civil Engineers held in Norfolk, Va., April 15-17. Four technical divisions—surveying and mapping, highway, waterways, and sanitary—held concurrent sessions on the second morning. The visitors spent the remainder of the three days in an inspection of the harbor of Hampton Roads as guests of the Pennsylvania Railroad and on an all-day bus trip to points of historic and technical interest on the Delamarva peninsula. The board of direction met preceding the general convention, and its accomplishments were reported in our news pages last week. Miami, Fla., was selected by the southern regional meeting committee as the scene of the spring meeting in 1932. At the student chapter conference about twelve universities and colleges were represented.

Transportation

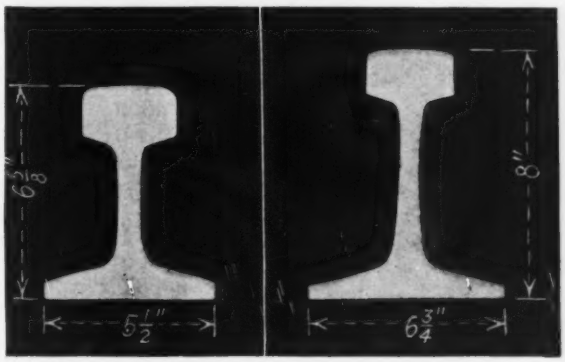
The outstanding transportaiton paper, at least in so far as news value was concerned, was delivered by W. S. Franklin, Pennsylvania Railroad, assistant to the vice-president in charge of operations. The Pennsylvania made Mr. Franklin's address the occasion for the initial public announcement of two new rail sections, the first heats of which will be rolled by the U. S. Steel Corp. and the Bethlehem Steel Corp. about the middle of May. The sections and a new splice bar are the result of two years' research by a joint committee of the railroad's engineers and engineers of the steel companies. One new section weighs 152 lb. per yard, is 75 per cent stiffer and is 8 in. high, 1⅜ in. higher than the present standard 130-lb. section, first rolled in 1916. The 152-lb. rail is the heaviest yet rolled. The second new section is a redesign of the 130-lb. section, following general principles determined during the development of the 152-lb. section. The result is a section 22 per cent stiffer and weighing only 131 lb. The principle of the redesign is to take some metal from the head, making it shallower than heretofore, and distributing this metal to provide a somewhat thicker tapering web and a broader base.

The need for these new rail sections has been demonstrated by greatly increased track maintenance costs over the past few years, brought about by the practice of using heavier engines. The old rail sections were designed for 80,000-lb. axle loads at 80 miles per hour, whereas the new sections will permit 100,000-lb. axle load at 100 miles per hour. It is felt that these sections, together with the new splice bars, one of whose advantages is increased resilience, will mean safer, smoother and more silent railroad travel.

Mr. Franklin outlined the Pennsylvania Railroad's policy as being a desire to use and coordinate every known means of transport. He pointed to the pioneer development of air-rail transportation, promising 24-hour transcontinental service as soon as the airways are completely lighted; to the purchase of numerous bus companies and their integration with railroad facilities; to the use of trucks for local freight on 49 routes covering 1,770 miles daily; and to the use of container body trucks for city delivery. In connection with the last named Mr. Franklin made the important announcement that the Pennsylvania is soon to inaugurate a detachable truck body service between New York and Philadelphia. These bodies, fitting both the truck and a standard railroad car, can be transferred at will from one to the other, facilitating store-door delivery and saving unloading and loading costs. Similar service is to be started between Baltimore and Salisbury, Md., involving not only train and truck but ships as well across Chesapeake Bay.

In opening his discussion of water transport Mr. Franklin mentioned the new transatlantic sailings to be inaugurated in July between Baltimore and Hamburg by the Pennsylvania Railroad, using modern 500-ft. boats of 15,000-ton displacement. The Panama Canal act and the Dennison bill, prohibiting railroads from operating boats through the canal or on inland waterways, were severely criticised by Mr. Franklin, who characterized them as class legislation severely handicapping the railroads by thwarting them in their attempt to expand and coordinate all forms of transportation facilities.

The Port of Hampton Roads was described by



New Pennsylvania rail sections

Present 130-lb. rail compared with the new 152-lb. section now being rolled for the Pennsylvania Railroad. The lack of symmetry in the larger section is due to photographic distortion.

J. Gordon Bohannan, chairman, State Port Authority of Virginia, who stressed its strategic location both for commercial and military operations. Based on the premise that the efficiency of any port depends not alone upon physical facilities but also upon the degree to which these facilities are tied together, the port authority is working toward complete integration of the Port of Hampton Roads. A tunnel or new and faster barge lines are needed to connect the Norfolk and Newport News areas in a more efficient manner. A second objective of the port authority is to develop effective ways and means of interesting residents of the interior portions of the state in the development of the port. Recreation features are one solution.

Lytle Brown, Chief of Engineers, U. S. Army, outlined the history of flood control on the Mississippi and described the genesis of the present plan and the factors that dictated its selection, all of which have been exhaustively treated in this journal by General Brown and others. It was General Brown's stated opinion that adequate bank protection at less cost than the present $300,000 per mile is the real hope of proper control of the Mississippi. Bank protection is still largely an unsolved problem.

Some remedies for coast erosion were discussed by Lieut. Col. E. J. Dent, Corps of Engineers, U. S. Army. Jetties and groins are unsightly but often necessary. It is uneconomical to build them higher than the beach, since the land end will be covered completely with sand. For this reason also it is not necessary to fill in the land end of jetties with rock, since this portion is required to absorb only relatively small shocks. In devising means of building up a beach the economics of the alternate possibilities of increasing the heights of jetties or of securing sand by artificial means such as pumping should be weighed carefully. Colonel Dent is apparently an advocate of the latter method for many locations, his plan involving pumping excess sand onto the beach and permitting the wind and lateral drift of waves to distribute it along the beach. A new dynamometer for measuring wave forces is being developed by the army engineers, and it is hoped soon to have some of them in operation to secure wave force data that are much needed.

Surveying and Mapping

The first-order triangulation networks now being laid out will place every point in the United States within 25 miles of a control station, and Raymond S. Patton, director of the U. S. Coast and Geodetic Survey, in charge of the work, made some important comments relative to the use that engineers should make of this first-order control. Availability of accurate control points should reduce surveying costs, permit different projects to be tied into one another easily and make plane-surveying methods immune from the effect of earth curvature for most practical engineering purposes. Control stations should foster increased utilization of plane table methods, which are by far the best means of topographic mapping. Aerial surveying is increasing at a rapid rate, and accurate control points will be a boon to its growth. State triangulation systems, for the most part incomplete, inaccurate and contradictory, can be logically and accurately extended by virtue of the new control stations. Captain Patton remarked upon the importance of the first order system for city planners and others, and pointed out that the loss of a single benchmark would not be so serious in the future, when there should be a vastly increased number of markers, all tied into a control station.

The first-order system will not be entirely complete for about twelve years, but in the meantime state, railroad and other engineers should work toward third-order accuracy, in which in strips 159 miles wide and any length north and south control points are located with an error not greater than 1 in 5,000. North Carolina is working on such a program, according to George F. Syme, senior highway engineer of the state. Mr. Syme advocated the use of plane coordinates for laying off highway and railway curves as much more accurate than methods now in use.

River studies are seldom susceptible of coordination with other topographical data, according to Gerard H. Matthes, principal engineer, U. S. engineer office, Norfolk, Va. River data are collected for a special purpose or in many cases for a variety of purposes such as flood control, navigation, water power, irrigation or water supply, and it should not be expected that many unnecessary data be collected merely to tie in the work with some future project. Standardization of river survey methods is impracticable because of diverse nature of streams and data required. A profile of a river and its tributaries is most necessary and important and overshadows any possible advantage of an accurate topographical map of the watershed. That is, the location of points on a vertical scale is all important in river work; horizontal location is secondary.

Aviation

Three papers on aviation occupied the time of the second session. E. B. Conroy, district traffic manager of National Air Transport, Inc., described the elaborate equipment and some of the troubles of modern commercial aerial transportation. Extensive weather reporting, radio beacon route marking and radio communication with pilots are among the important aids to safety and efficiency. Research on ice formations on airplane wings is yielding gratifying results in the way of preventives, although no sure cure is yet practical enough to try extensively.

Capt. George C. Kenney, Langley Field, reviewed army aviation in a realistic review of the use of airplanes in the World War, pointing out that aircraft will be a vital if not deciding factor in the next war.

Naval aviation was discussed by Capt. Kenneth Whiting, Hampton Roads Air Station, with particular stress on the development of airplane carriers such as the "Saratoga" and the "Lexington" and of means for launching planes from battleships, now largely accomplished by catapults having an acceleration of about $1\frac{1}{2}$ *g*.

Sanitary Division

In the sanitary division two interesting papers of local interest were presented by Walter H. Taylor, III, director of public works, Norfolk, and J. N. Chester, consulting engineer, Pittsburgh, on Norfolk's sewerage and water-supply problems. Many new catchment and storage areas were required by the city just before and during the war. The new pipe lines, filtration plant and distribution system that have been built since were described by Mr. Taylor. Mr. Chester also touched upon the history and description of watersheds and presented details of his consulting work in connection with the

revision of Norfolk's pumping station. In discussion, pumping, pipe coefficients and bacteria-forming tubercles were considered by John R. Gregory, Malcolm Pirnie, Asher Atkinson and H. L. Nelson. E. S. Whitman (Baltimore) described methods of reducing tuberculation at Staunton, Va., by lime treatment.

In presenting a voluminous report of the committee on New Jersey sewage experiments, C. E. Keefer, of Baltimore, was able to do little more than outline the chapter headings. High temperatures were found to increase the rate of sludge digestion. Foaming and scum are treated in detail in the report. Serious cutting of sludge by centrifugal pumps led to the recommendation of reciprocating pumps for this service. Mechanical stirring was found to increase the rate of sludge digestion at temperatures from 70 to 85 deg. F. Fat is readily digested at 75 deg. Enzymes aid digestion. Digestion of raw sewage is not inhibited by prechlorination, with certain qualifications. The direction of air currents through trickling filters was reported as depending on barometric pressure and temperature.

Convict Labor for Roads

Virginia is benefiting from the use of convict labor on its state road system and, except possibly at present when unemployment is extensive, free labor is not harmed, according to H. G. Shirley, commissioner of the department of highways. Several disagreed with this view. Mr. Shirley stated that the convicts save the state about $680,000 a year, which can be expended on other needed improvements built by free labor. By using the convicts on road work Virginia is able to put off building a new $3,000,000 penitentiary. The net return to the state is about $100 per convict. It costs 75c. a day to maintain a man in a road camp. It was also argued that the use of convicts on roads was good for the men themselves and eliminated the danger of riots such as have occurred in New York, Illinois, Ohio and Kansas.

Arbitration

Papers on the subject of arbitration of public-works contracts were presented by Charles H. Stevens, chief engineer, department of city transit, Philadelphia, and Philip A. Beatty, staff engineer, bureau of municipal research, Philadelphia. Mr. Beatty's paper involved a detailed discussion of arbitration procedure. Arbitration has only recently been extended to public-works contracts, but at present an agreement to arbitrate either a future or existing dispute is valid, irrevocable and enforceable under the laws of New York, New Jersey, Massachusetts, Pennsylvania, California, Oregon, Louisiana, Connecticut, Rhode Island, Arizona and New Hampshire and the Territory of Hawaii. Arbitration avoids the formalities, delay and expense of litigation and provides for the settlement of disputes by those with specialized knowledge rather than by jury. In supporting arbitration, engineers are not surrendering any portion of their ancient powers, said Mr. Beatty, for arbitration will never be invoked until the engineer and contractor have reached a deadlock.

Mr. Stevens pointed out that arbitration on public-works contracts differs from commercial arbitration in that it involves granting permission to the contractor to appeal from a decision of the engineer that otherwise would be final. An arbitration clause has been used by the Philadelphia department of city transit since 1928. Resort to arbitration has been found necessary only once (to settle a question of interpretation of plans), although 45 contracts for subway construction and equipment, covering a total expenditure of about $30,000,000 have been awarded by the department under specifications providing for arbitration. Mr. Stevens' paper will be published in a forthcoming issue.

Waterways

Three papers, related to a certain degree, were delivered before the waterways division and were titled the Port of Baltimore, the Waterways of the National Capitol and the Atlantic Intercoastal Waterway. Advantages of Baltimore harbor are its comparatively large size, a tidal range of only 1.2 ft., a 36-ft. deep ship channel, an absence of ice, good navigation conditions, adequate shipping and handling facilities and a substantial labor supply. These advantages were listed by Lieut. Col. Warren T. Hannum, district engineer, Baltimore, who also stated that the federal government's expenditure of $14,000,000 in the Port of Baltimore has resulted in an annual carrying charge of $560,000, or 3½c. per ton of shipping.

In discussing the waterways of Washington, D. C., Major Joseph D. Arthur, Jr., district engineer, reviewed the history of maintenance since the early days of the last century. A 24-ft. deep channel is now maintained in the Potomac River. No effort has been or is being made to develop Washington into a commercial port.

Two physical factors make an Atlantic intercoastal waterway feasible—the existence of many islands protecting the channel from the ocean and the existence of the several peninsulas that form such bays as Chesapeake and Delaware. Major Gordan R. Young, district engineer, Norfolk, visioned such a waterway as performing a service in the East similar to that performed by the Mississippi River in the Middle West. Some work has been done by the federal government and some by private capital, but there is as yet no concerted effort being expended on the project. There is a modern 12-ft. channel available from Philadelphia to Beaufort, N. C., but development work in the South is notably absent.

Longest Railway Lift Span

The longest vertical-lift railroad drawspan is said to be the 408-ft. span for the new Missouri River bridge of the Missouri-Kansas-Texas R.R. at Boonville, Mo., which will give a headroom of 57 ft. at low water. This span, with three 300-ft. fixed spans and one of 247 ft., will be of the through riveted-truss type, with one through girder span of 60 ft., all designed for Cooper's E-70 loading. The lift span will be electrically operated, automatically controlled by safety devices and interlocked with the automatic block signals. A contract for the design, fabrication and erection of the superstructure has been awarded to the American Bridge Co. Erection will begin next summer and the bridge is to be completed by Jan. 31, 1932. The concrete substructure, built in 1930 by the Kansas City Bridge Co., is founded on rock, and the river piers were sunk by the pneumatic process to a maximum depth of 50 ft. below low water. This work will be in charge of R. M. Stubbs, bridge engineer, under the supervision of F. Ringer, chief engineer, Missouri-Kansas-Texas R.R. The completed structure will cost about $1,233,000.

Managua—Its Construction and Utilities

An engineer intimately familiar with the capital city of Nicaragua tells of the structural shortcomings of its buildings in resisting earthquakes and why its utilities were completely disrupted during the recent disturbance

By HENRY WELLES DURHAM
Consulting Engineer, New York City

MANAGUA, capital of Nicaragua, was destroyed by earthquake and fire on March 31. Buildings collapsed like card houses and the water-supply system was completely disrupted. Engineers and others immediately raised the question as to whether such complete destruction could have been avoided. The question was answered, briefly, in the affirmative by Lieut. Col. Daniel I. Sultan in a statement published in the news pages of last week's issue. A further answer is given in the following comment by Henry Welles Durham, for the past five years the representative of R. W. Hebard & Company in the construction of a modern water-supply and sewer system and in the paving of streets in Managua. —EDITOR.

THE RECENT disastrous earthquake in Nicaragua again directs attention to the problem of designing buildings and municipal utilities that either will be able to withstand the disruptive forces set up by such an earth movement or at least will not be damaged beyond repair. In reviewing the Managua earthquake for light it may cast on the problem, the inquirer wants to know what happened to man's works, and why; how they could have been bettered; and whether destruction was inevitable in the Managua region?

He who seeks an answer to these questions should first note these facts: except for minor details, building types remained unchanged for three centuries previous to 1920 throughout Central America. Previous to 1923 no city throughout the five republics had modern municipal improvements. Until after 1925 neither Managua nor any other Nicaraguan town had either pavements, sewers, water supplies worth consideration, nor any but the most inadequate electric lighting. Outside of Managua there is in Nicaragua not a square yard of paved street, nor a mile of improved hard-surfaced road, not a sewer, nor a water-works capable of delivering potable water throughout a community or of throwing a fire stream from a hydrant.

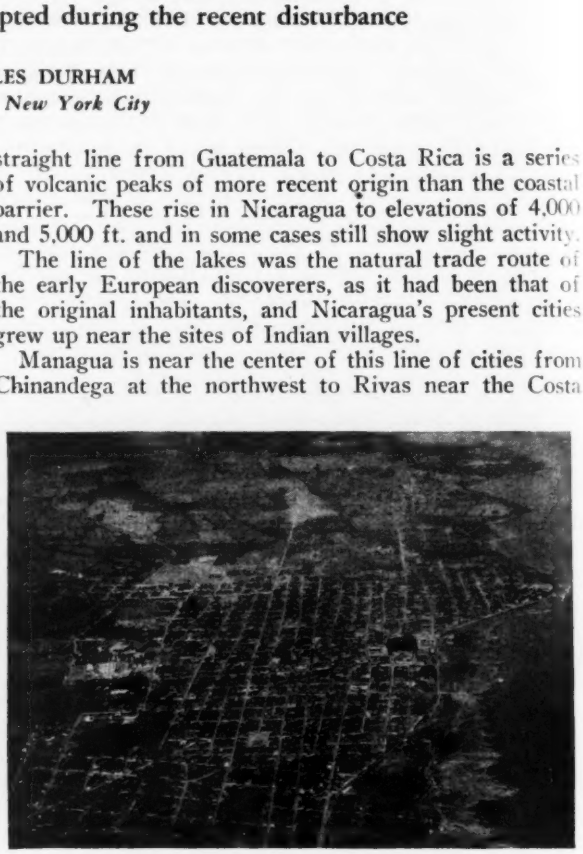
Managua had some of these things. It had more new buildings than any other city. It had a few fire hydrants. It was flattened by an earthquake and then burned for lack of water.

Managua's location is on the south shore of Lake Managua. The basin of this lake and that of the larger Lake Nicaragua occupy the site of an ancient gulf cut off from the sea by an upward movement that built up the sierra, or range of low hills, now dividing the lakes from the Pacific. South and west of Managua this range at a distance of 10 miles rises to an elevation of 3,000 ft. and extends at a lower elevation southeast to the vicinity of the Port of San Juan del Sur (near which point is the lowest divide between Atlantic and Pacific drainage in all the Americas) and northwest to the plain of León and the vicinity of the Port of Corinto.

Along the axis of the lakes and following a nearly straight line from Guatemala to Costa Rica is a series of volcanic peaks of more recent origin than the coastal barrier. These rise in Nicaragua to elevations of 4,000 and 5,000 ft. and in some cases still show slight activity.

The line of the lakes was the natural trade route of the early European discoverers, as it had been that of the original inhabitants, and Nicaragua's present cities grew up near the sites of Indian villages.

Managua is near the center of this line of cities from Chinandega at the northwest to Rivas near the Costa Rican border. It is near the junction with the route to the hill towns of the northwest and the only cross-country route to the headwaters of the streams flowing to the Caribbean shore.



Managua before the earthquake

Lake Asososca from which the new water supply was drawn is shown at the upper left corner. Lake Managua is at the right side.

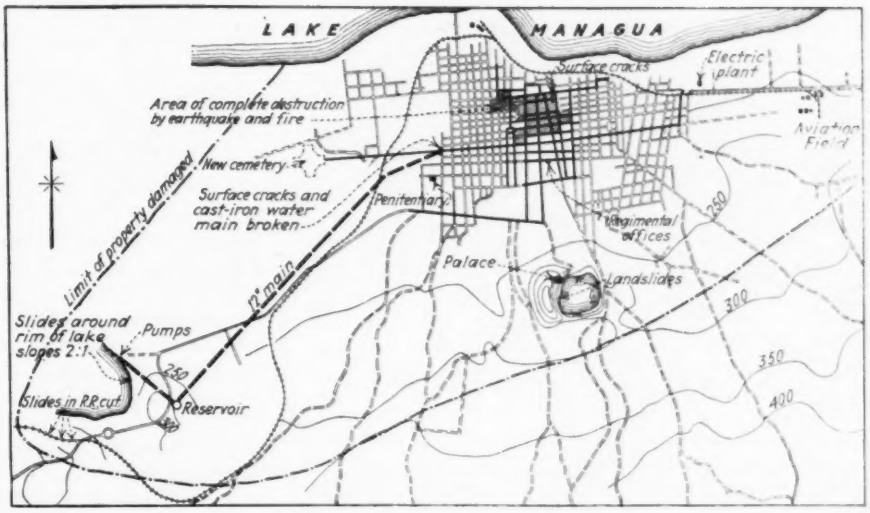
In consequence, Managua has been for many years, in addition to the seat of government, an important business center for shipping coffee from the plantations on the coastal and central hills. A considerable cattle-raising industry also centers about this area.

Since earliest history a bull-cart trail followed this axis of population. Later the westerly end of Lake Managua was connected by rail to Corinto, and another line ran from Managua to Granada with connections by steamboat on the lakes and down the San Juan River to Greytown. Early in this century the two railroads were united by building a line west from Managua, and when, with the opening of the Panama Canal, Greytown ceased to be a port of call for steamships, all of the country's traffic went west from Managua to Corinto.

Motor vehicles were infrequently used until recently. During the period of civil war from 1925 to 1927 nearly all privately owned cars and trucks were taken for military service and destroyed by rough usage. Subse-

quently, extensive importations of cars began, and there were several hundred in use in the Managua region last year, both for passengers and to carry shipments of coffee for near-by plantations. The Marine brigade operated a fleet of trucks over the road to the north whenever weather conditions made the route passable. They supplied their district outposts by airplane.

Questions of sanitation received no attention in Nicaragua until the last decade, when the Rockefeller Foundation supervised the organization of a sanitary department and made attempts to secure the improvement of public water supplies. There were a few inadequate plants, but the bulk of the populace in each community depended for water on wells or streams near by.



Zone of earthquake damage at Managua

The streets shown as full lines are paved and have sewers and water mains. This map is reproduced from one prepared by Lieut. Col. Daniel L. Sultan from surveys made by the author.

City Site—The city of Managua with a rectangular plan extends about 1 mile along the lake and about ½ mile in width back from the shore. The ground slopes down toward the lake at a grade of from 1 to 3 per cent, the highest part of the city being 75 ft. above the lowest street at the railroad, which skirts the lake front at an elevation of about 140 ft. above sea level and 10 to 15 ft. above the lake level, which fluctuates with the seasons. The track west from the city climbs by a circuitous route to an elevation of more than 500 ft. passing along the rim of the crater Lake Asososca, where slides recently covered the track, and then descends by a long loop to the shore of Lage Managua. A direct line would have saved grade and distance. The route is said to have been chosen for scenic and political reasons.

Water-Supply Sources

Immediately south of the city and 1 mile from the lake there stands a large mound-like hill, crescent-shaped in plan, which rises to 450 ft. around the edge of an ancient crater, containing within its rim a deep fresh-water lake of about 40 acres. The similar but much larger crater lake of Asososca, 240 acres in extent and 900 ft. maximum depth, lies 2 miles west. Both of these lakes or "lagunas," the levels of which are very constant, are somewhat above that of Lake Managua and are virtually deep wells supplied by the underground drainage flow from the hills to the southward.

Little use was made of them except for watering cattle and washing clothes, and until 1928 the only public water supply for Managua was taken from collecting galleries and shallow wells near the lake shore, thus utilizing the groundwater supply after it had filtered through the city's numerous cesspools. A duplex double-acting steam pump with wood-fired boiler and a maximum capacity of less than 1 m.g.d. delivered water through a rusty 8-in. cast-iron main, with a limited distribution net in the cross-streets of 3- and 2-in. cast-iron branches and some smaller lines of galvanized iron. All pipes were in leaky condition and delivered probably only half the quantity pumped.

The population in 1925 was estimated to be less than 30,000. It is possible that it had increased recently to nearly 40,000. No census or reliable statistics existed.

In plan the city was laid out in approximately square blocks of 300 to 400 ft. So-called "avenues" ran from north to south, "streets" from east to west. In general, all streets were approximately straight and narrow, often with 40 ft. or less between buildings and narrow footwalks at irregular levels. No pavements existed prior to 1926, but occasional stone ramps impeded washouts where the heavier grades were found. In times of torrential rain the streets became rivers.

There were from six to twenty houses per block, usually solidly built up on the street front and surrounding inner patios or courts. They were usually but one story in height.

Buildings of Native Stone

Character of the Buildings—The foreign observer has frequently stated that this and similar towns were of adobe. This is not correct. Adobe block or solid mud walls were not usual. There exists below the surface soil in this region a layer of sand and gravel washed down from the hills, and underlying the whole area is a hardened volcanic mud or *tufa*, except in the vicinity of near-by craters where there are hills of sand and outcrops of lava and andesite.

This soft mud rock lies under Managua at a depth of from 12 to 15 ft. From early times the inhabitants of this region have been accustomed to open quarries by surface stripping, and they get out this material in large blocks. It can be shaped by bars and a kind of ax. These stones were used to build walls in all the better-class buildings, usually of 12 in. or more thickness. The result was a substantial structure, but as lime mortar was usually employed and much flat-arch construction was used over doors and windows, there was little resistance to heavy earth trembling. Houses with walls of this construction would extend, one room in thickness, around three or four sides of an open court. Roofs were A-framed of timber with a covering of lighter strips (sometimes of cane in the older types) on which the outer surface of tile was laid.

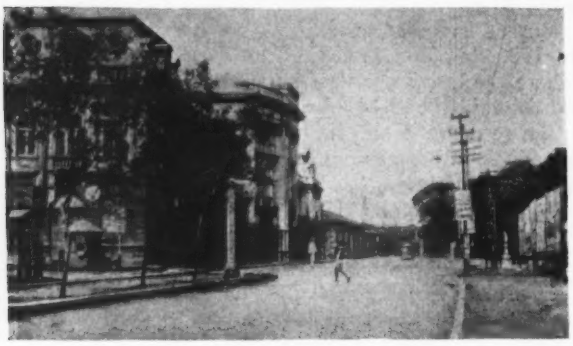
The tiles were not anchored in any way or mortared except in valleys and ridges, and were half round in sec-

tion laid alternately concave and convex, forming a waterproof protection when new but easily jarred loose by vibration. Large shuttered door and window openings were provided inside and out, but there was seldom any glass used. The inner part of the roof around the patio extended down over a terrace or corridor. This type of building was used both for residences and places of business. Often both uses were combined. Coffee planters utilized the inner gallery for a work room for their sorters and to store the bags awaiting shipment. The public markets were of this type of construction with the entire court area covered with sheet-iron roofing and crowded with small booths.

Timber and Rubble Construction

Another popular type of construction utilized a similar ground plan with walls framed of timber, on which were fastened horizontal slats, and the intervening space between vertical members filled with random rubble, laid up in a mud or lime mortar. Both types of wall were surface plastered inside and out and usually had a final finish of cold-water paint. Plaster cornices were recently introduced for exterior ornament and were formed on a base of cut stone or more often by plastering on wire netting or barbed-wire strands fastened to projecting boards.

Ceilings frequently were not attempted, but in the more pretentious dwellings they were either of canvas nailed to a frame below the roof or of tongue-and-groove



The national palace in Managua

hard wood. Ground floors were invariably cement tiles laid directly on the surface.

In the central part of the city many buildings were of two stories, the first of wood-frame construction with stone filler between laths. The poorest dwellings were of rough-hewn or pole frames with wall coverings of cane plastered with mud, but almost all had tile roofs, although corrugated galvanized iron and thatch was sometimes employed.

The national palace or capitol occupied a block fronting on a park near the lower central part of the town. This structure, started in President Zelaya's time and recently completed, had been 40 years in building. Its stone walls were two stories in height. Floor beams, floors and roof were of wood. In design it was a somewhat pretentious imitation of the French type of public building with a mansard roof housing a false third floor, and an elaborate central bay of vertical columns in front, rising out of the main design like an excrescence. The architect exhausted his ingenuity in the picture, and no thought was given to structural design. Floor beams of squared timbers resting in wall niches spanned the area between walls with just sufficient strength to hold ordinary loads. The walls rested directly on the soil at the level of the ground floor. The roof was covered with sheet iron, and the exterior walls were plastered and painted.

Reinforced-Concrete Construction

Recently various German, Italian and French contractors and builders had introduced a new type of reinforced-concrete building of two and three stories. Frequently the design was more or less rule-of-thumb, employing old railroad iron as vertical members between which concrete walls as thin as 4 in. were poured. A notable case of home-made design was in a church wall reinforced with old iron bedframes and barbed wire.

In this class of buildings a cement concrete was used, proportioned as the laborers judged proper, of German cement, run of bank sand and disintegrated lava from a near-by hill. The most pretentious structure of this type of concrete was the new presidential palace that was erected on the hill overlooking the crater lake of Tiscapa south of the town. It rested in part on a lava outcrop and in part on the overlying gravel and sand which formed its outer slope. To strengthen this outer face a retaining wall of soft stone blocks was laid up on a sand base. The structure was well reinforced with rods but was on a site chosen, without regard to foundation conditions, for its scenic and strategic location.

The new post office, recently completed, was of interest in that it employed to some extent pressed-steel floor beams between walls of soft stone. Its walls were erected several years previously to a height of two stories and left unfinished during the period of civil war. When the new government decided to complete it in 1929 the work was given to another contractor, who utilized the steel beams for the ceiling of the second floor and employed the more usual light wooden beams to carry his floor load. A plastered ceiling was hung from the steel and a wooden frame roof erected above it. Apparently the steel was not regarded as safe for a great load. The new brewery and cathedral were of framed steel construction.

Municipal Improvements

In 1925 the government, recently installed, entered into a contract with R. W. Hebard & Company, Inc., of New York, which provided for the sanitation and paving of the city in accordance with plans to be prepared by the contractors and approved by the government. The writer was general manager and chief engineer representing the contractors and for five years had charge of this work. During this time there were

The national palace after the earthquake but before the fire

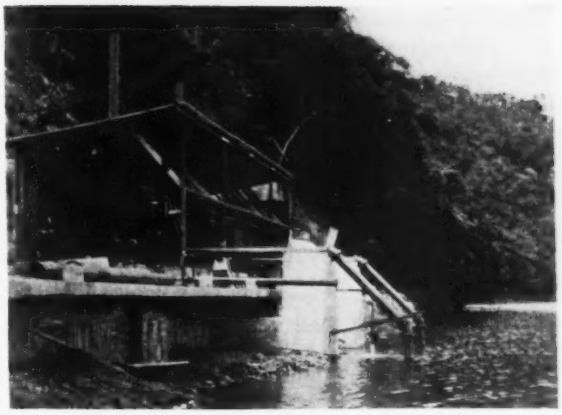
extended periods of revolutionary activity and civil war. The government that made the original contract was overthrown shortly after work was started. In the five years it was carried on under four presidential administrations and under the supervision of some dozen different ministers of public works and finance. At various times work was suspended by street fighting, and there was occasional impressment of laborers and motor vehicles for military use. Lack of funds occasioned a shutdown for a period of six months, and at no time was there any certainty that funds would long be available for continuation. The work, as planned and approved officially, was to include a complete new water-supply and distribution system, storm and sanitary sewers and the paving with asphaltic macadam of all streets, including the construction of concrete curbs and gutters.

Reduced national resources due to the financial depression, added to a natural lack of interest in the projects of its predecessors, led the present administration to decide to terminate the partly completed improvements last year. There had been finished work to the value of nearly one million dollars. Streets in the central area, or about one-third of the total had been provided with separate sewers for house drainage and stormwater (all of cement pipe reinforced in sizes about 24 in.) and with water mains of cast iron and house connections and were paved. Water was supplied from a new and pure source and in quantity was adequate for the population and double any previous consumption.

The new water-works took its supply from Asososca lake. This source, whose water had been repeatedly tested as satisfactory in all respects for a potable supply, had the approval of Dr. Daniel M. Malloy of the Rockefeller Foundation and was preferred by the government because of a local prejudice against the water of the nearer lake, which was believed to be poisoned at times by volcanic gases.

New Pumping Plant

The project as carried out included the installation of a pumping plant on a rocky shelf near water level at a place formerly used by washerwomen and to water cattle. It is reached by an inclined descent down a 200-ft. cliff. A reinforced-concrete foundation and floor was constructed on a platform levelled in hard rock at this point, and two pumping units were installed, each consisting of a 120-hp. diesel motor, connected through reduction gear to a three-stage centrifugal pump. The total capacity with both pumps was 1,500 gallons per minute from the lake level of about 140 ft. to the reservoir at about 440. The force main connected to both pumps by a manifold was a 12-in. spiral-welded pipe with flexible joints anchored to concrete foundations up the rocky cliff to the top of the crater, from which point the line was 14-in. cast iron on a moderate grade for about 1,000 ft. to the reservoir. The latter was a circular tank of 1-m.g. capacity, about 160 ft. in diameter and 20 ft. deep, with a central partition wall, all of concrete with steel rod, hoop and double vertical reinforcing, built in six segments with interior brackets and tied to a spread reinforced foundation floor. It rested on a base of solid rock excavated on the edge of a hillside at a suitable elevation to provide gravity flow to the city with an average hydrant pressure of from 50 to 75 lb. under normal rates of flow. A crushed andesite was used as aggregate for this and all other concrete and paving construction. From this reservoir a 12-in. cast-iron supply line led to the city distributing mains, which were laid only under the paved streets and varied in size from 10 to 4 in. in diameter.



The pumping plant on Lake Asososca

Work was stopped before proper protection for the plant had been provided.

It had been planned to supersede the old plant by the new one throughout the city. In 1928 an arrangement was made whereby the government would sell at cost to the Central America Power Corp. (owner of the old water-works and electric-light plant) the new water-works, in so far as then completed, the funds received to go to the contractors for completion of the paving and sewers. The former company (a subsidiary of W. B. Foshay Co., of Minneapolis) agreed to make with the paving contractor a supplemental arrangement for the completion of the water-works. Operation was to be under new franchise terms. Had this plan been effected a completed work might have resulted. The failure of the Foshay Co. in the financial crash of that year ended this possibility; and the system, completed only as has been described, was turned over for operation to the power company on a limited agreement with the new government and without funds available for more construction. Our company ceased all additional construction, and the operating company cut in connections between the old and new systems and has been operating this patch-work ever since. The old mains were inadequate even under light pressures and developed many leaks under the added head. The few hydrants installed on the paved streets became the plaything of street waterers or whoever could use a wrench, and they were speedily in damaged condition.

The plan had included a reinforced-concrete house over the pumps, designed to protect them from slides. This was never built. The intakes were hastily installed with insufficient permanent protection and no provision for fluctuating lake level. The gate house at the reservoir was unfinished. All these shortcomings had been anticipated in planning, but the contractors unfortunately were not given an opportunity to finish their work. A solution-feed chlorinator was in operation, but a venturi registering apparatus was never set up after delivery.

Failure Due to Faulty Construction

Reports of the earthquake show that the poorly built structures came down, while those properly framed of wood or of steel and concrete did not. Damage was negligible to the new water mains, sewers and pavements. The pumps were buried by the anticipated slide against which they were unprotected.

Nothing has happened to impair confidence in well-

built structures and conservatively designed public utilities. Although the absence of water to extinguish the fire is stressed in all reports, it should be noted that there has never been water to extinguish fires in Central American cities, and Managua never had a fire department. The few hydrants placed were not called for in the contract, and the public never realized they had other uses than as a source of water for street washing.

Perhaps the principal lesson that can be drawn is that no public utilities can be made self-operating or foolproof.

SINCE the preceding description of conditions in Managua before the earthquake was written, the Chief of Engineers has received a further report from Colonel Sultan as to the physical condition of the utilities of the city and other structures of engineering interest. Colonel Sultan's report bears out in a striking way the conclusions of Mr. Durham as to the probable effect of the earthquake. Colonel Sultan's report is given below. —EDITOR.

The zone of surface cracks passed through points three blocks west of the extreme western points of the burnt area and through the northwest corner of the penitentiary building, which was very completely destroyed. Cracks indicate that the fault line runs northeast to southwest. Each individual crack has a direction north to south.

Building construction in Managua was extremely poor. There were no complete steel-frame buildings in the city and only about twelve reinforced-concrete buildings. As far as can be determined, the concrete in these buildings had an extremely large loam content. Reinforcing steel was limited and poorly spaced.

We are unable to determine exactly the sewer damage, but the main lines seem to be in good shape. The water supply of Managua came from Lake Asososca, but the rim of this deep crater lake is shattered and the pumping plant is buried under landslides. Reasonable precaution would have prevented this by the construction of a retaining wall. No damage was done to the reinforced concrete water-works reservoir, and damage to the pipe line appears to be limited. Most house connections, however, were broken. A small amount of water is being pumped into the mains by an auxiliary pumping plant set up on Lake Managua. Damage to the diesel pumps at the pumping plant buried under the slides is unknown. Engineers are attempting to salvage that plant and establish a new intake on Lake Managua.

Filler Material Requires Study for Proper Oil-Mix Road Design

By T. E. STANTON
Materials and Research Engineer,
State Division of Highways, Sacramento, Calif.

THE IMPORTANCE of studying the qualities and oil capacity of the filler material in aggregate to be used for oil-mix roads has been emphasized by recent laboratory studies carried on by the California state division of highways. Wide variation in oil capacity was found for various types of filler material, which met the common requirement of passing the 200-mesh sieve. As a result, it is the practice in this state, before beginning construction of an oil-mix road, to make sieve analyses of the aggregates to be used and to give particular attention to the characteristics of the material passing the 200-mesh sieve, including its oil capacity, before fixing the oil requirement for the entire mix.

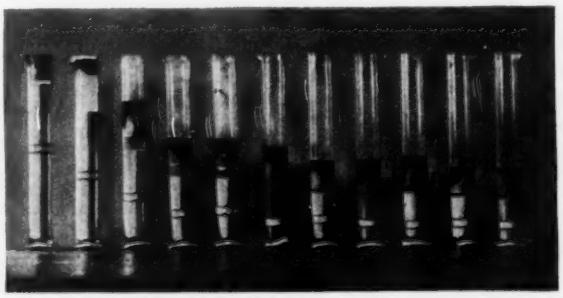
The surprising variation found to exist in what is ordinarily classed as filler material (because it passes the 200-mesh sieve) is illustrated by one of the tests made on a group of samples. Eleven different filler-material samples, each 100 grams, were placed in graduated cylinders. The material included limestone dust, portland cement, hydrated lime, silica dust, talc, pumicite and diatomaceous earths. The loose volumes of the 100-gram samples varied from 65 to 300 c.c. A cork was driven down to the top of the loose material, as it had deposited itself in the cylinder, and the container was then pounded to produce maximum settlement. Compacting resulted in a decrease in volume of from 8 to 13 per cent.

The following step was to treat each sample of filler with asphaltic fuel oil (60 to 70 per cent asphaltic content) until they were similar in consistency and general appearance. A wide variation in oil requirement was found to exist in the various types of material, the ratio of weight of oil to weight of filler varying from 15 to 150 per cent and the ratio of volume of oil to volume of loose dust varying from 20 to 50 per cent. The result of this test demonstrates the fact that it is misleading to regard all material passing a 200-mesh sieve as filler to be treated uniformly.

The oil capacity of a mass of minute particles varies with their fineness and with the character of the surfaces. This variation is large enough between different materials to produce decidedly dissimilar results in cases where the weight of filler or the oil content is maintained constant. Differences in filler material, for the sake of better classification, might be expressed as a surface-area function, adsorption capacity, or by a more general term such as oil requirement.

Application of this study to actual highway construction in California includes the special analysis of the filler portion of the aggregate material which the contractor proposes to use. After making a wash-sieve analysis of the aggregate, the material passing the 200-mesh sieve is studied further to determine its special characteristics and oil requirements. The result of this special study of the filler material combined with the analyses of the coarse and fine aggregates determines the percentage of oil fixed for the entire mix.

The details of this laboratory study are being carried out by H. G. Bennett and F. N. Hveem, junior testing engineers of the asphalt and oil department, under the writer's general supervision.



Equal weight samples of filler material
Note the large variation in volume and varying reduction due to compacting.

NEWS OF THE WEEK

Award for Boston Federal Building Is Held Improper

AFTER examining into the procedure concerning the contract award for the construction of the new federal building in Boston, Comptroller General McCarl has become convinced that the award was improperly made. The treasury department has been informed, therefore, that the $4,648,900 contract for the work with the N. P. Severin Co., of Chicago, must be abrogated.

In his report the comptroller general states that after making substantial alterations in the specifications the treasury department should have readvertised the work instead of permitting the contractors to make supplemental bids. Through their action in negotiating with bidders after several alterations in the specifications, the treasury officials were not complying with the law requiring proper advertising of government work, the report also states.

Two Bids Called For

The original specifications, issued Dec. 12, 1930, called for two lump sum bids in the alternate, bid 1 being for construction complete with granite to the third story and limestone from the third story, while bid 2 was for granite for all stories. Provision was made in the specifications for granite construction in order to accede to the demands of Massachusetts members of Congress, who protested against bringing in Indiana limestone.

On the first advertisement for bids fourteen proposals were received, the lowest on bid 1 being from the Seglin Construction Co., of New York, for $4,763,700 and the lowest on bid 2 being from the George A. Fuller Co., of New York, for $5,582,000. Both of these proposals were in excess of the balance of $4,602,305 allotted for the work. Supplemental bids were invited, and as a result, ten bids were received. These were also in excess of the amount available, so further bids were requested, this time seven being received.

Unsuccessful Bidder Protests

Based on its second supplemental bid of $4,648,900, the award was made to the N. P. Severin Co. The Seglin Construction Co., however, protested that its original bid of $4,763,700 was less than the amount available provided the item of $250,000 reserved for contingencies be reduced to the amount reported to the committee on appropriations of the House. If the contingent work should be held necessary, the Seglin company agreed to do $250,000 worth of work for $88,605.

Validity of Moffat Tunnel Lease Is Upheld

Validity of the contract by which the Moffat tunnel was leased to the Denver & Salt Lake Railroad was upheld on April 20 when the U. S. Supreme Court declined to review the decision of lower courts sustaining the lease.

In January, 1926, the commission leased the tunnel to the railroad company on the basis of a payment of two-thirds of the interest for the then outstanding bonds and two-thirds of the principal as the bonds came due. The bond issues then amounted to $8,220,000. Before the tunnel was completed a total of $15,470,000 of bonds had been issued and in 1929 the commission began action to force the railroad to pay rental on the increased cost. The lower courts sustained the railroad in its contention that its contract with the commission was not affected by the issue of additional bonds after the lease was signed. This interpretation of the contract is sustained by the supreme court's decision.

Fatal Chicago Tunnel Fire Confined to Timbering Behind Concrete Lining

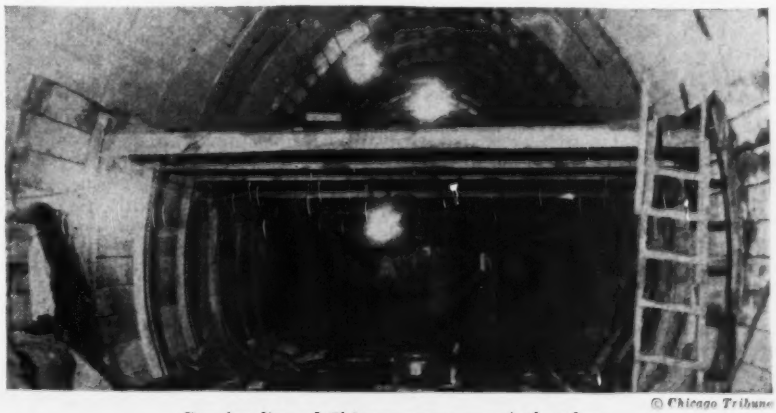
ELEVEN MEN, four firemen and seven workmen, lost their lives in a fire that started on the evening of Monday, April 13, in a concrete sewer tunnel under construction for the Sanitary District of Chicago. The fire was confined to the timbering, 3x6-in. maple cants, in place between the clay tunnel walls and the concrete lining of a completed section near the shaft. There was no open blaze and no one was fatally burned, but great quantities of smoke found their way into the tunnel and the loss of life was due to suffocation or asphyxiation. A preliminary report of the accident appeared in *Engineering News-Record*, April 16, p. 663.

The section of tunnel under contract is part of the West Side intercepting sewer in 22d St. leading to the proposed treatment plant at Stickney. It is of horsehoe section, 17 ft. high and 17 ft. wide. At the point of disaster, 22d St. and Blue Island Ave., there was 20 ft. of cover on the completed line. The reinforced-concrete lining varies from 17 in. thick at the crown to 28 in. thick at the haunches. The contract, covering 10,000 ft. of tunnel, was let to the Ryan Company, Chicago, four months ago.

A single shaft, offset 60 ft. from the center line of the sewer and connected to it by a monkey drift, provides access to the tunnel. Construction is being carried on in both directions from the monkey drift, and to date has proceeded 300 ft. in each heading. The monkey drift is also concrete lined.

The soil through which the tunnel is driven is a soft, sticky clay, and is excavated with clay knives and air spades. Limestone rock has appeared at the invert in the east heading and at the present working has attained an elevation 2½ ft. above subgrade. Solid timbering, consisting of five sets of 3x6-in. maple-heart crutching, resting on a sole plate just above the springing line, supports the tunnel arch. Wood forms are used and the concrete is placed by hand. Full concrete lining is carried close to the face to insure the safety of the work.

To assist in supporting the soft clay heading, compressed air at 5 lb. pressure



© Chicago Tribune

East heading of Chicago sewer tunnel after fire

Sixteen men sought refuge in this section when trapped by smoke. There are no marks of smoke or fire evident.

is used in both headings. Steel air locks, 9 ft. in diameter and 40 ft. long, are set into a 24-in. concrete bulkhead which is keyed into the concrete lining. Just behind each bulkhead there is a 24-in. mud ring, 8 in. deep, to prevent leakage of the air from the heading back along the surface of contact of the concrete lining and the timbering, with the timbering and concrete lining omitted at this point. Two similar mud rings had been left in the walls of the monkey drift to provide for a bulkhead, but had never been used for that purpose.

Soft Clay Dries Out

Although the soft clay had never been wet enough to cause trouble, the warm dry air pumped into the headings had dried it out further and caused that at the mud ring to crack. Sawdust was being used to calk up these cracks to prevent air leakage. Just before the fire started, it is reported, a workman was calking the cracks in the mud ring in the east heading, using a candle flame to indicate the points of air escape.

Whether as a result of this operation or not, the timbering behind the completed concrete lining became ignited, and, fed by the draft caused by leaking air, the fire was carried past the bulkhead toward the monkey drift. Large quantities of smoke and other products of combustion entered the drift and the short section of tunnel under free air, forcing workmen in this chamber to leave. Some of them returned to combat the fire. When they did not reappear in a reasonable time, rescue squads of the fire department were summoned. Firemen reported intense heat in the tunnel and smoke so thick that strong searchlights were completely blanketed, but no flame.

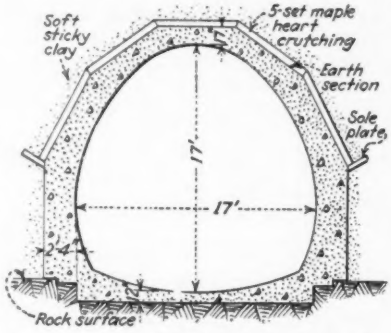
"Smoke Ejector" Saves Rescuers

The first rescue squad to enter the tunnel, trapped by the dense cloud of smoke and noxious gas between them and the shaft, sought refuge in the east heading behind the bulkhead. At that point there was no smoke or fire and, after fourteen hours, they, in company with a group of workmen, were brought out in safety. Their escape was made possible by the operation of a newly constructed "smoke ejector," brought hurriedly to Chicago from Kenosha, Wis., and put to work at the tunnel shaft.

Air pressure was maintained in both headings for some hours after the fire had started because of the presence of a 30-in. gas main in the street directly over the tunnel. It was feared that the release of the compressed air would endanger the stability of the street above, allowing a break or large leak in the gas main in close proximity to the fire, entailing even more serious consequences. The main was finally shut off and the air was then released.

Sewer Not Badly Damaged

An inspection shows blackened concrete for the entire space between the bulkheads and in the monkey drift. Behind the bulkheads, in those sections under pressure, there is no indication of the effects of smoke or flame. It has not yet been determined how the smoke found its way from behind the concrete into the tunnel barrel. One theory is that it passed through the concrete lining due to the 5-lb. difference in pressure; another is that it followed the back surface of the lining and entered the tunnel through cracks in the unused mud ring in the monkey drift near the shaft. Explorations from the surface reveal charred timbers behind the concrete from the east bulkhead to the center of the monkey drift. Further explorations are being carried out to determine the extent of the fire. It is not considered that the integrity of the sewer has been impaired in those sections already lined with concrete.



Cross-section of Chicago sewer tunnel
Fire burned only in timbering between clay tunnel walls and concrete lining.

New York Asks Bids for First Section 6th Ave. Subway

The New York board of transportation will receive bids on May 19 for the construction of the first section of the Sixth Ave. four-track subway route, the final link in the city's independent rapid-transit system, under construction since 1925. Starting the Sixth Ave. line has been delayed pending decision as to disposal of the existing Sixth Ave. elevated railroad. Efforts have been made to have the elevated structure removed prior to building the subway underneath because of increased hazards and cost of the subway work. Although the subway is eventually to take the place of the elevated, the present traffic on the elevated line could not be readily absorbed by other means, in the opinion of transit officials, so the overhead railway will continue in operation during the subway construction. Because of existing subways, elevated line, Hudson & Manhattan tubes, P.R.R. tunnels, the Catskill aqueduct, all occupying portions of Sixth Ave., and the character of the rock to be encountered, the subway construction will be the most difficult of all the city's rapid-transit lines. The first call for bids covers the section between 43d and 53d Sts. A description of the Sixth Ave. line and difficulties to be met in its construction appeared in *Engineering News-Record*, Jan. 22, 1931, p. 136.

Contract Let for Hamilton Dam Near Burnet, Tex.

Contract has been awarded for construction of a dam across the Colorado River near Burnet, Tex., to the Fegles Construction Co., Ltd., Minneapolis, Minn., by the Emery, Peck & Rockwood Development Co., Chicago, for about $3,200,000. The site of the dam and 30,000-hp. hydro-electric plant is about 50 miles north of Austin. The plant will cost, together with the land to be submerged by the reservoir, approximately $1,500,000. A 5-mile railroad is being built to the site from the Southern Pacific line.

The dam will be about 9,000 ft. long, of multiple arch type and about 137 ft. high above streambed. It will contain 130,000 cu.yd. of concrete and form a reservoir 30 miles long. To reduce the time required to accomplish reservoir filling, the specifications require the beginning of storage after the dam is half completed.

Construction of the dam will be directly in charge of Charles R. Conkey, Minneapolis, vice-president and general manager of the Fegles Construction Co. About 800 men will be employed on the job. The Fargo Engineering Co. is consulting engineer.

Shore and Beach Experts Meet in Norfolk

The annual spring "inspection-trip" convention of the American Shore and Beach Preservation Association, held in Norfolk, Va., April 13 and 14, was attended by about 50 engineers, who listened to three papers on timely questions and examined the Atlantic shore line from Willoughby's Spit, at the entrance to Hampton Roads, to Virginia Beach. The inspection trips gave the members an opportunity to compare virgin and improved shore line and to note the efficacy of groins and jetties in building up a wide, flat beach.

The principles of riparian ownership were discussed by J. L. Barron, a Norfolk attorney and state senator, while Prof. Wilbur Nelson, of the University of Virginia, presented some aspects of the geology in the coastal plan region of Virginia. In describing Toronto's new harbor reclamation work, E. L. Cousins, consulting engineer, board of harbor commissioners, stressed the importance of including and coordinating terminal, industrial and recreational facilities. Public support was assured by adequate recreational facilities. An important technical aspect of the work was the provision of an exit channel from the land-locked harbor to insure a circulation of water and prevent stagnation.

In a talk on beach ownership Victor Gelineau, director, New Jersey board of commerce and navigation and secretary of the association, urged that municipalities or states acquire and develop the beaches, for private efforts at beach protection are notoriously ineffective.

New Charter Adopted in San Diego, Calif., by a Large Majority

Approaches Typical Council-Manager Plan—Sets Up Qualifications for Engineering Positions

A COUNCIL-MANAGER charter for San Diego, Calif., was adopted on April 7 by a vote of 22,621 to 5,765. This action followed the defeat of a somewhat similar charter project in December, 1929. If ratified by the legislature, which is customary for home-rule charters in California, the charter will become fully effective on May 1, 1932. For many years the city has had an operating department, in charge of a superintendent or manager (see *Engineering News-Record*, 1915, II, p. 187). The population of San Diego by the 1930 census was 147,855.

The charter follows the typical council-manager type in most respects. It provides for a short ballot; the initiative, referendum and recall; extensive but not complete separation of legislative and administrative functions, with a manager in control of most of the latter; civil service for administrative officers, except some thirty department heads and for members of commissions serving without pay; and a budget formulated by the manager, subject to amendment by the council.

Engineering Departments Set Up

Departments having to do with engineering and public works include engineering works, water, harbor and planning. The city engineer is independent of the works department and may have assigned to him by the manager any of the divisions under that department, which include streets, sewers, refuse collection and disposal, public buildings, shops, and pueblo lands and unimproved property. Each of these divisions is in charge of a superintendent, under a director of public works. The water department is in two divisions: development and conservation, and distribution. The harbor department is under the commissioners and must be provided with $150,000 a year until 1938 for harbor extensions. The city planning commission is governed by statewide legislation.

The charter contains a number of provisions designed to put and keep the city on a sound financial basis: One requires that each budget and appropriation ordinance shall provide for a permanent revolving fund designed to keep the city on a cash basis. Another requires the formulation yearly of a long-time public improvements program, with statements of whether the requisite funds are to be provided from loans or taxes. Still another contemplates putting the water department on a self-sustaining basis. Bonded debt limits are fixed at 10 per cent of the assessed valuation subject to direct taxation, with 15 per cent additional for water-works, but all bond issues must go to the electors for approval and must have a two-thirds majority of all the votes counted.

Technical Requirements Outlined

Aside from its civil service provisions designed to insure the appointment of competent men to office, the charter lays down technical or other requirements for a number of appointees, including the city engineer, the two water engineers and the director of health.

Some of the deviations from the typical council-manager charter are: The mayor, who in most respects has no other power than the six other members of the council, appoints the harbor, sinking fund and civil service commissioners, all subject to confirmation by the council; the members of the harbor and the civil service commissions may be removed by the council. The council appoints three of the nine members of the city planning commission, including a councilman; the manager appoints four members; the city engineer and city attorney are ex-officio members. The manager's appointments of chief of police and chief of the fire department must be confirmed by the council, but these officials may be removed by the manager alone.

Improvements to Dallas Airport

Extensive improvements to Love Field, the municipal airport of Dallas, Tex., have been made possible by a favorable vote on a $300,000 bond issue. Floodlights will be installed on the hangars, about 70 acres will be added to the east side of the field, two concrete runways 150 ft. wide will be run diagonally across the field and another runway will be laid east and west. These improvements will make possible all-weather use of the field.

Acme Photo

NEW TYPE AVIATION MARKER

This 60-ft. tower, to serve as an aviation marker, has been constructed by Ludo L. Zinner, of Cleveland, Ohio, near the Cleveland municipal airport. It tells the aviator the latitude and longitude near which the tower stands. Besides serving as a marker, the tower includes a service station and restaurant.

Contract for Hoover Dam Construction Is Officially Signed

Wilbur Affixes Last Signature—Concrete Consulting Board Approves Plans and Specifications

THE bid of nearly $49,000,000 submitted by Six Companies, Inc., for the construction of Hoover dam and appurtenant works at Black Canyon on the Colorado River was officially accepted April 20 when Secretary of Interior Ray Lyman Wilbur signed the contract in Washington. Officials of the contracting firm as well as Dr. Elwood Mead, commissioner of reclamation, and Raymond F. Walter, chief engineer of the bureau of reclamation, had previously signed the document.

On the same day the bureau's board of consulting engineers, consisting of D. C. Henny, L. C. Hill and A. J. Wiley, approved the plans and specifications for the dam. A special cement and concrete board, comprising P. H. Bates, W. K. Hatt, H. J. Gilkey, F. R. McMillan and R. E. Davis, met the next day, but its conclusions are not known as we go to press. At a meeting in January this board had outlined tentatively some proposed laboratory studies of cement and concrete.

The Colorado River board of engineers, appointed in 1928 by congressional authority, will meet in Washington this week to pass on certain features of the plans and specifications of the project. This board of review consists of Gen. W. L. Sibert, D. W. Mead, Robert Ridgway, W. J. Mead and C. P. Berkey.

Construction Work Proceeding

Construction work on parts of the project is active. Six Companies is extending an existing road from a point at the river's edge a mile above the dam site to the upper portals of the diversion tunnels on the Nevada side; a railroad may later be built over this road. The Lewis Construction Co. has completed about a third of the grading and excavation for the railroad being built from Boulder City to the rim of the canyon above the dam, and has holed through two of the five short tunnels on the line. About half of the grading is completed on the highway construction between Boulder City and the dam site. La Tourneau, Inc., is doing the work.

Riverside Votes Against Joining Metropolitan Water District

Voters of Riverside, Calif., on March 31 rejected a proposal that the city join the Metropolitan Water District of Southern California, by a vote of 5,264 to 1,231. Riverside is the fifteenth city to vote on the proposition and the first to reject it. Opponents of the proposal contended that the city has a water supply adequate for many years to come.

Report Assails Chicago Plan for School Construction

Condemning the system of divided responsibility existing in the architectural department of the Chicago board of education which has resulted in serious defects in several new structures, a committee of engineers and architects has recommended changes in the present administrative set-up of the board. To remedy the chaotic conditions, the committee advises the board to secure experienced executives; to give them adequate compensation, power and responsibility; and "to protect them from the insidious pressure of selfish interests."

This committee was appointed to investigate the methods prevailing in the design, construction and repair of school buildings after disclosures of an expert investigation found serious defects in several costly new structures. Divided responsibility due to "invisible government," resulting in thorough disorganization and inefficiency in the architectural department of the board, is given as the cause of defective and unsafe construction in school buildings, some of which were "so dangerous that they were unfit for use upon completion." The division of responsibility is such, according to the report, that neither in the board itself nor in its architectural department could any one person be held responsible for omissions or commissions. Lack of leadership and evasion of civil service regulations, with consequent waste, excessive costs and general lowering of morale, are mentioned. No reflections are cast on individuals, as they are said to be "largely victims of an evil system," while it is "the insidious system and the disorganization it produces that we wish to indict." As to defective work, the report states that the main difficulty seems to have been "faulty construction on the part of contractors and field inspection that was unfaithful and frequently ignorant."

Specific recommendations made by the committee provide that the chief architect should not be subject to civil service but should be appointed by the board of education on the basis of high attainments and leadership qualification. He should have sole charge of the department and be empowered to contract with private practitioners for design and construction of some of the school buildings. The report points out the necessary lack of business efficiency in an "administrative board of unwieldy numbers, limited term of office and varied opinions."

U. S. Supreme Court Defines Navigable Waters

In ruling on the master's report in the dispute between Utah and the United States over the title to portions of the beds of the Green, Grand and Colorado rivers, the U. S. Supreme Court has held that the determining point is whether or not the rivers in question are navigable. The suit was brought by the United States to quiet title to certain portions of the beds of the rivers on the contention that the government acquired these titles in the treaty of Guadalupe Hidalgo of 1848. By this treaty it is contended that the United States acquired from the Republic of Mexico the title to all lands riparian to the rivers together with the river beds.

On the other hand, the State of Utah claimed title adverse to the United States. Both the state and the United States have granted a number of prospecting permits in the disputed territory. Charles Warren, the special master to whom the case was referred, concluded in his findings that the title is vested in the State of Utah in the case of rivers that are found to be navigable but where the rivers are non-navigable the title remains vested in the United States.

Despite the contentions of the government that the rivers are not navigable the supreme court has sustained the principles involved in the master's report. In the opinion of the court, the issue rests upon whether or not the rivers were navigable when the State of Utah was admitted to the Union in 1896. In deciding on navigability, the court has ruled that it is not correct to use a narrow interpretation.

As a test of navigability, the supreme court has handed down the following rule: "Those rivers must be regarded as public navigable rivers in law which are navigable in fact and that they are navigable in fact when they are used, or are susceptible of being used, in their ordinary conditions, as highways of commerce, over which trade and travel may be conducted in the customary modes of trade and travel on water."

It is true that some of the commerce on the rivers in question was composed of lumber rafts and that some of the rest of the navigation was of a private nature, constituting traffic for surveying and mining operations. Despite this, the supreme court has been convinced by the evidence submitted that extensive use has been made of portions of the rivers by public commerce vessels such as steamboats, flatboats and motor boats.

It is therefore ruled that the complaint of the United States shall be dismissed so far as it relates to portions of the beds of the rivers found to be navigable and that the title in non-navigable portions shall remain in the possession of the United States.

NEW AETNA CASUALTY & SURETY CO. BUILDING, HARTFORD, CONN.

Completed early this year, this palatial structure is the largest yet built embodying a Colonial architectural motif. It is 660 ft. long and 252 ft. wide and has a volume of 11,000,000 cu.ft. The cupola is 232 ft. above the ground. Foundations consist of 343 concrete piers on rock 30 to 70 ft. below the surface. The building is of structural steel with a brick and limestone exterior. It is situated on a plot of 17 acres. James Gamble Rogers, of New York, was the architect and the George A. Fuller Co., also of New York, was the builder.

$3,000,000 Hydro-Electric Project in Alaska

A permit has been issued by the Federal Power Commission to the Portland Canal Co., of Seattle, Wash., for the construction of a hydro-electric power project on the Davis River in southeastern Alaska. The first work will be a 400-ft. dam, costing $144,756. Other work projected includes a 1,000-ft. tunnel with concrete-lined diameter of 18 ft.; a diversion tunnel 600 ft. long; a penstock 800 ft. long; and a 2,000-ft. cableway. The project, which is located near Hyder, Alaska, will cost approximately $3,000,000 when completed.

RANDOM LINES

The Blueprint

By Elldee

In order to erect a church of solid walnut, brick or birch, a chicken house of glass and steel or restaurant of pine and veal, a blueprint must be made to show where rooms and studs and faucets go; the length and breadth and height of doors and longitude of steps and floors.

Before the blueprint can be made some patient yap—who's poorly paid—must draw the plans up on foolscap—which, by the way, is not a snap—then trace them on transparent cloth, free from windshakes and knots and moth. The blueprint then is made from this by some blueprinter—man or miss.

The background of the blueprint's blue, we might as well confide to you; while lines and figures are in white and needs must be correct (or right). For if a figure tells a lie, the careworn, plugging, sob-soaked guy who made the paper drawing first is beaten, mauled and kicked and cursed!

"Hello!—You got that *blueprint* done? Well, send it over on the run! You promised it six hours ago—you make me crazy as a crow! The workmen cannot go ahead until they get that print—nuff sed! Now, step on it! Speed up! You *hear?* Sure, this is Blots, the engineer."

* * *

Clever, These Chinese

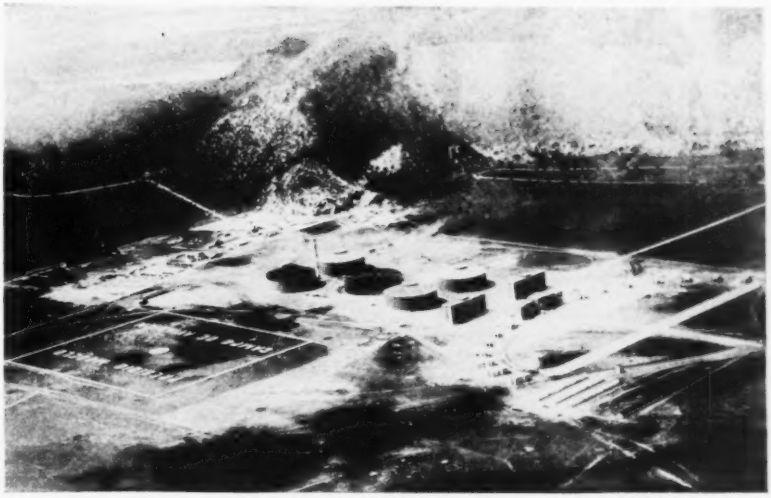
Snapped in Mukden, China, by H. E. Babbitt during his recent trip to the Orient.

* * *

At Last We Have That Straight

Certain persons of an inquiring turn of mind have long wondered why our ancestors built covered bridges. The problem is neatly stated in *Arkansas Highways:* "What our forefathers found, either about their bridges or the streams over which they crossed, which seemed to require the protection of a roof, often constructed at large expense, is a riddle almost too deep for the modern mind to fathom."

One modern mind attacked the riddle by inductive reasoning in the New York *World:* "As I remember the old bridges, the sides were a mass of trussed beams, probably 4x10 in., crossing the entire length of the bridge. Now it is not likely that they built all of that timber work to hold up a roof. [A neat point, that.—Editor.] The truss beams were to strengthen the bridge and the roof was, of course, to finish off the top."



Publishers Photo Service

CUBA CONSTRUCTING MODEL PRISON

On the Isle of Pines the Republic of Cuba is constructing what is announced will be a model penal institution. The above illustration shows four of the units completed. In all there will be eight such units, all circular in shape and interconnected. The prison, which is to be completed in 1933, is being constructed of granite quarried from near-by mountains.

California Engineer Charged With Gross Incompetency

Charges alleging "gross incompetency" have been filed with the California state board of registration against J. G. Little, San Francisco, by M. M. O'Shaughnessy, city engineer, San Francisco, and N. A. Eckart, manager city water department. The charges result from a report which was prepared by Little on the threatened water shortage of the city and compiled, according to the charges, "without proper or adequate investigation and without proper or adequate examination of the matter and things which the report purports to cover." The board has set a hearing for May 14.

Beauharnois Power Corp. Seeks Additional Rights

The Quebec government has passed an order-in-council permitting the Beauharnois Power Corp. to divert an additional flow of water to enable the company to develop more horsepower in the plant now under construction at Beauharnois, on the St. Lawrence River above Montreal. The project was originally planned to develop eventually 500,000 hp. It was stated in the application that additional power will be needed to supply industries that are expected to be established in the vicinity. The additional privilege has been granted on a lease which expires in 2003, and the additional rental will be $15,000 a year for the five-year construction period and $37,500 thereafter. The additional right is subject to approval of the dominion government, and the power developed under this privilege may not be exported without the consent of the lieutenant-governor-in-council.

New York City Acquires Private Water Company

On April 15 New York City, on payment of $2,000,000, took title to the property of the Long Island Water Corp., a private company which has supplied water to the Rockaways section of the city. This section, which covers an area of approximately 4,000 acres and has a permanent population of about 60,000 and a summer population of about 120,000, will in future be served with city water.

The only private water companies of material size remaining within the boundaries of Greater New York are the Jamaica Water Supply Co., the New York Water Service Corp., supplying the Flatbush section of Brooklyn, and a subsidiary of the latter, serving the Woodhaven section of Queens.

Land Reclamation at Dallas 60 Per Cent Completed

The work of straightening Trinity River, constructing levees and reclaiming bottomlands on each side of the stream through almost the heart of Dallas, Tex., and for some distance out of the city is now 60 per cent accomplished. Up to the first of April $12,365,000 had been expended and the work still to be done is estimated to cost $8,205,000. The levees have been completed on each side of the new channel for 10 miles. The cost of the improvements is divided among the city, county, railroads, utilities and private property owners. Straightening of the river and construction of the levees not only will prevent overflows but will make possible utilization of a wide strip of waste land lying between the principal business district of Dallas and the populous residential section of Oak Cliff.

Brief News

A TAX of ½ mill per kilowatt-hour on all electrical energy generated in the State of Idaho is levied by a bill recently passed by the Idaho legislature.

CONTRACTS for 400 miles of road paving in Louisiana, amounting to nearly $10,000,000, have been approved by a citizens' advisory board, sitting jointly with the state board of liquidation.

CITY MANAGER form of government was retained by the voters of Niagara Falls, N. Y., by 1,658 votes at an election held on March 25. The plan rejected was a return to the board of aldermen system.

A CONTRACT for approximately $250,000 worth of steel water pipe for the city of Los Angeles has been awarded the Western Pipe & Steel Co. The order includes 40,000 ft. of pipe, ranging in diameter from 24 in. to 36 in., to be used in the extension of the distributing system of the Los Angeles water department.

JOINT PURCHASE by the states of California and Arizona of the toll bridge over the Colorado River at Ehrenberg on the central Arizona highway is authorized by a bill passed by the Arizona legislature and signed by the governor. The purchase price is $325,000. A similar bill is pending in the California legislature. Under the terms of the bill the bridge will continue to be operated as a toll bridge until the purchase price is recovered, after which it will be free.

EXPENDITURES totaling $2,271,060 in improvements are planned by the San Diego (Calif.) Consolidated Gas & Electric Co. during 1931, according to an announcement by W. F. Raber, vice-president and general manager. Electrical generation, transmission and distribution systems will get $1,325,000 of the total; $750,000 will be spent in the gas production and distribution departments, and $200,000 will go for miscellaneous expenditures, including the steam distribution system.

PLANS TO ELEVATE the tracks of the Santa Fe Railroad in Oklahoma City have been agreed upon, and the railroad is about to embark on a $5,000,000 improvement program which includes the erection of a new station. Plans call for underpasses at all streets now open.

CONTRACTS for construction in Canada during March represented a value of $27,311,800, an increase of 5.3 per cent over the previous month, and 12.6 per cent over March, 1930. Contracts for business buildings, valued at $10,080,300, were 36.9 per cent of the total. Engineering work continued high with $9,993,800, or 36.6 per cent, Residential took care of $5,568,700, or 20.4 per cent, and industrial $1,669,000, or 6.1 per cent.

The Business Outlook

It becomes increasingly clear that the spring stimulus this year has not been sufficient to start business climbing out of the valley. Such as there has been seems to be fading somewhat early. Our index has been sliding off slowly during the past four weeks, but at 78.6 per cent of normal it still stands somewhat above the low points touched in the past five months, and there is no suggesion that general business is likely to go to lower levels than have been established since last November. The March and early April evidence in employment, textile activity, iron and steel and automobile production, in building and retail trade, encourages the belief that recession has been checked, but not the hope that an upturn will be early or rapid.

—The Business Week, April 22.

Minnesota to Build Highways With State Bond Issue

A $15,400,000 state highway bond issue has been authorized by the Minnesota legislative to be expended during the next two years. Previous practice has been to carry on highway work out of current taxation and gasoline tax revenue, but the department has been unable to keep up with traffic requirements. Maintainence costs, particularly, have increased rapidly on sections of highway that could not be paved because of lack of funds. About $5,400,000 of the bond issue will be spent this year and the remaining $10,000,000 in 1932.

The program calls for 825 miles of paving and 1,258 miles of grading to standard requirements. It is estimated that this bond issue will put the highway program in a position to be carried on in the future with current revenues. Of the 7,000 miles designated as state trunk highways there are 1,434 miles paved, 1,150 surfaced with bituminous material, 1,895 graveled to standard, 2,120 graveled but not up to standard, and the remainder is only graded.

Contractor Claims Extras on Cushman Dam Construction

The city of Tacoma has received claims amounting to $238,273.30 from L. H. Hoffman, contractor for the dam and spillway on the city's second Cushman power development, as extra compensation. The contractor claims that the plans were changed by the city after the contract was let and that rock excavation greatly exceeded the engineers' estimates. A balance of $139,071 has been asked for river diversion and excavation for the dam out of a total actual cost plus 15 per cent of $290,104. Increasing the reinforcing in the dam which changed the classification of 16,198 cu.yd. of concrete resulted in an additional claim of $71,271.

COSTS AND CONTRACTS

E. N.-R. Index Numbers

Cost			Volume		
Apr. 1,	1931	191.63	March,	1931	278
Mar. 1,	1931	194.51	February,	1931	198
Apr. 1,	1930	207.12	March,	1930	408
Average,	1930	202.85	Average,	1930	260
Average,	1929	207.02	Average,	1929	317
1913	.....	100.00	1913	.....	100

This Week's Contracts

Heavy construction contracts, reported by *Engineering News-Record* in the week of April 23, with some comparisons, total as follows:

(In Thousands of Dollars)

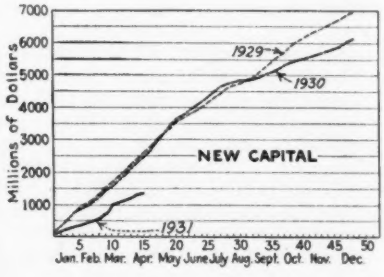
Buildings:	Apr. 23 1931	Average of Last Four Weeks 1931	1930
Industrial	$2,269	$6,216	$4,718
Other	14,076	19,724	40,122
Streets and roads.	16,685	15,116	13,338
Other eng. constr..	21,476	24,864	18,168
Total	$54,506	$65,921	$76,347
Total, all classes, Jan. 1 to April 23:			
1931		$926,769	
1930		1,131,546	

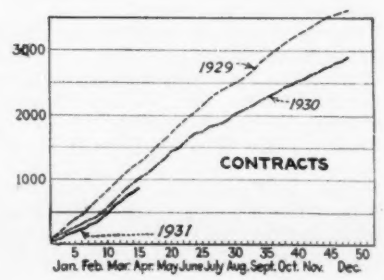
Capital and Contracts

Last week's new capital total of 22 millions was the smallest in several years. Only 6 millions private capital was issued, and 16 in public bonds. Of the 16 millions, 8.2 were St. Louis 4s for buildings, and 2.2 Charlotte, N. C., 4½s for general improvements. The accumulated grand total for the year is 1,381 millions, compared with 2,495 millions a year ago.

Contracts totaled 65 millions, compared with 62 millions a year ago. Accumulated figures are given below.

	1931	1930	Per Cent Ch'ge.
Industrial buildings....	$67,417,000	$120,456,000	—44
Other buildings	271,957,000	451,732,000	—40
Streets and roads.....	173,470,000	140,874,000	+23
Other construction.....	359,419,000	335,752,000	+7
Total.....	$872,263,000	$1,048,814,000	—17
Per cent drop in capital issues.....			—45





Personal Notes

FRED R. DONALDSON has been elected vice-president of Ulen & Co., according to an announcement from the general office of the company at Lebanon, Ind. He has been president of Donaldson & Co., a subsidiary of Ulen & Co., which is engaged in building construction in the Middle West.

H. W. MCCURDY has been elected president of the Puget Sound Bridge & Dredging Co. Mr. McCurdy has been with the organization since 1922, when he started as timekeeper. He succeeds John W. Roberts, president of the company for the last two years, who has retired from active business.

MARCELLUS P. LEE, recently with the war department, Randolph Field, Texas, is now with the supervising architect, treasury department, as construction engineer on the new post office at Louisville, Ky.

JOHN W. ROBERTS, president of the Puget Sound Bridge & Dredging Co., Seattle, Wash., has resigned because of ill health. He has been succeeded by H. W. MCCURDY, former vice-president and general manager. RAYMOND J. HUFF, former auditor, has become vice-president.

CLARENCE L. STURDEVANT, major, corps of engineers, has been named engineer of the Seattle district by the war department, to succeed Major John S. Butler, present engineer, who will be given a new assignment.

R. E. J. SUMMERS has resigned as vice-president and contract manager of the H. K. Ferguson Co., of New York, to become president of Summers Engineers & Constructors, Inc., which will specialize in industrial engineering and construction, with offices in New York and Cleveland.

E. H. SHIPMAN, chief engineer of the Lehigh & New England Railroad Co. and corporate engineer of the Lehigh Coal & Navigation Co., has removed his office from Bethlehem, Pa., to Allentown, Pa.

STANLEY ABEL, of Taft, Calif., has been appointed a vice-president of the American Road Builders' Association to fill the vacancy caused by the death of Samuel Hill, of Seattle, Wash. Mr. Abel is a former vice-president and president of the county highway officials' division, was chairman of the county committee on regional surveys and plans for several years and is now chairman of the county committee on public relations.

R. C. KELLOGG, previously with the Central Illinois Co. as engineer, advising on the purchase of new bond issues from economical and engineering considerations, is now acting as vice-president of the Pacific Water Co. at San Mateo, Calif.

R. C. MARSHALL, Jr., has joined the B-W Construction Co., Chicago, as vice-president in charge of the recently established New York office. Mr. Marshall is a graduate of the U. S. Military Academy and during the World War was a general in charge of the construction division of the army, which executed construction work costing approximately $1,300,000,000.

Obituary

DANIEL H. DEYOE, of the industrial engineering department of the General Electric Co., a director and member of the American Welding Society and for many years identified in electric arc-welding activities, died in Schenectady April 11, at the age of 55. He was a graduate of Union College, class of 1898, and joined the General Electric organization the same year and became affiliated with the industrial engineering department in 1906.

ADOLPH YAPPEN, assistant engineer of bridge maintenance on the Chicago, Milwaukee, St. Paul & Pacific R.R., died at Rochester, Minn., April 4. Mr. Yappen was born in Schleswig in 1860, and coming to this country when young he entered the University of California, where he received the degree of B.S. His early engineering experience was on the Northern Pacific Ry., but he went to the Chicago, Milwaukee, St. Paul & Pacific in 1893 and was for several years a district carpenter, becoming assistant engineer of bridge maintenance in 1919. Mr. Yappen was a member of the American Society of Civil Engineers, the Western Society of Engineers and the American Railway Bridge and Building Association.

FRANK E. DAVIDSON, architect and structural engineer, of Chicago, died suddenly in that city on April 14. Mr. Davidson was born at Hillsborough, Iowa, in 1867, and was graduated from the Iowa State College in 1890. During 1890 and 1891 he was assistant engineer on the construction of the Grand Canal at Phoenix, Ariz., and then was with Samuel Artingstall, George A. Fuller and other Chicago engineers until 1896, when he organized the F. E. Davidson Co. for engineering and contracting work. In 1898 he was superintendent of sewers at Chicago, but later went into practice as an architect, specializing in industrial and commercial buildings. Mr. Davidson was a member of the American Society of Civil Engineers and a past-president of the Illinois Society of Architects.

SOCIETY CALENDAR

AMERICAN SOCIETY OF CIVIL ENGINEERS, New York; summer meeting, Tacoma, Wash., July 8-10.

AMERICAN SOCIETY FOR TESTING MATERIALS, Philadelphia; 34th annual meeting, Chicago, June 22-26.

AMERICAN WATER WORKS ASSOCIATION, New York; annual convention, Pittsburgh, Pa., May 25-29.

AMERICAN WELDING SOCIETY, New York; annual meeting, New York City, April 22-24.

AERONAUTIC DIVISION, American Society of Mechanical Engineers, will hold its fifth national technical meeting in Baltimore, May 12-14, under the auspices of the Baltimore Section, American Socieyt of Mechanical Engineers, Engineers Club of Baltimore and the local sections of the American Chemical Society, American Institute of Electrical Engineers, American Society of Civil Engineers, American Society of Steel Treaters, Illuminating Engineering Society and the Institute of Chemical Engineers.

MONTANA SECTION, American Water Works Association, held its sixth annual convention, April 9-11, at Anaconda, Mont., attended by about 65 delegates. The new officers elected are: president, Harry M. Johnson, superintendent of the public service department of Anaconda Copper Mining Co., Anaconda; vice-president, C. P. Wells, city engineer of Great Falls; secretary-treasurer (re-elected), H. B. Foote, sanitary engineer, state board of health, Helena. Livingston, was selected as the meeting place for the 1932 convention.

NATIONAL ASSOCIATION OF RAILROAD TIE PRODUCERS lists the following papers for its annual convention at West Baden, Ind., on May 5 to 7: "Gum Ties on the Frisco Ry.," L. L. White, St. L.-S.F. Ry.; "Tie Futures and Prosperity," R. D. Garver, Forest Products Laboratory; "Relative Merits of Different Woods for Ties," W. R. Goodwin, Soo Line; "Care in Handling Ties Before Delivery to Railways," Horace Paul, Wabash Ry.; "Effect of Tapping Pine Trees on Decay of Ties," C. S. Burt, Illinois Central R.R.; "Identifying Defects Permissible Under Standard Specifications," C. A. Richards, Forest Products Laboratory; "Anti-Splitting Devices," S. E. Shoup, Kansas City Southern Ry.; "Tie Practice on the Monon Line," A. Anderson, Chicago, Indianapolis & Louisville Ry. The secretary is Roy M. Edmonds, St. Louis, Mo.

NEW YORK SECTION, American Society of Civil Engineers, at its regular monthly meeting on April 15, took as the subject of discussion the sewage-disposal plant now under construction on Wards Island in the East River. George W. Fuller, consulting engineer to the city on the project, was the principal speaker. The plant is designed to serve part of the upper end of Manhattan Island and part of the borough of the Bronx, an area having a population in excess of 1,000,000. The activated-sludge process is to be used, as is done in the North Side plant at Chicago, but the Wards Island plant will contain improvements in the process and in the details of the structure which have been developed as the result of experience gained at Chicago. These facts were noted by Samuel A. Greeley, consulting engineer, Chicago, in his discussion of Mr. Fuller's paper. Other speakers were L. C. L. Smith, of the New York City sanitation commission; C. A. Holmquist, of the state department of health, and George A. Soper, president of the former Metropolitan Sewerage Commission.

NEW YORK SOCIETY OF THE PANAMA CANAL will hold its seventh annual meeting at the Hotel Astor, May 2. Brig. Gen. Chester Harding, U. S. Army, retired, will be the principal speaker. Brig. Gen. C. W. Barber, U. S. Army, retired, is president of the society, which is composed of officials and engineers who worked on the Panama Canal.

PACIFIC NORTHWEST SECTION, American Water Works Association, will hold its fourth annual meeting at Vancouver, B. C., May 14-16. Many interesting papers are on the program.

TACOMA SECTION, American Society of Civil Engineers, elected R. K. Tiffany president and C. E. Putnam vice-president at its April meeting. The technical program was devoted to papers on the city's Cushman power project.

TAYLOR SOCIETY will hold its spring meeting in Philadelphia April 30 and May 1. The general theme of the meeting will be "Planning" and will include discussion of how to plan sales, production, work and labor relations.

Construction Equipment and Materials

Wood-Cored Thimble Developed for Nailing to Steel

To facilitate the attachment of wallboard, door and window frames, lath, roof sheeting, switchboxes and other attachments to steel-frame houses the Steel Frame House Co., Oliver Building, Pittsbugh, Pa., is now using a nailing thimble consisting of a brass thimble and a creosote-treated wooden plug. To install this device it is simply necessary to insert the metal piece in any hole or orifice in the steel frame of the building and then drive home the wooden plug. The result is a firm support for either nails or screws.

Dredger for Ditch Maintenance

Production of a continuous-action chain excavator for digging and cleaning irrigation and drainage ditches and for building highways and levees has been started by the Ruth Dredger Mfg. Corp., Ltd., 5980 South Boyle Ave., Los Angeles, Calif. The machine is equipped with patented automatic self-cleaning buckets, with bucket digging speeds and traction speeds synchronized so that maximum bucket capacity is maintained at all times. It is supported by a main crawler 24 in. wide and 12 ft. long and an extension crawler 7 ft. long and 12 in. wide mounted on a telescoping pipe shaft. The latter is carried on the opposite side of the ditch and can be adjusted to span from a minimum of 11 ft. 8 in. to a maximum of 16 ft. center to center of crawlers. Additional equipment can be furnished for longer extensions. A standard gasoline power unit is used for both propelling and digging. The transmission, of the plunger type, provides four forward digging speeds, two reverse speeds and two elevator digging speeds. The elevator can be raised and lowered by power while operating, and the carriage is movable through a range of 30 in. to conform to variations in ditch or canal. Steering is also controlled by power through positive clutches to the crawlers. The machine has a turning radius of approximately 11 ft. Manganese steel is used for bucket lifts, chain and hangers, as well as drive sprockets. Other equipment includes SKF self-aligning roller bearings and Alemite lubrication.

Dredger cleaning irrigation ditch

Versatile Leaning Wheel Grader

A new type of leaning wheel grader which features increased capacity, greater strength and a wide range of blade adjustments is announced by the J. D. Adams Co., Indianapolis, Ind. From the operating standpoint this machine offers many possibilties. The blade can be swung outward to cut a 60-deg. slope on a bank with the wheels on the level; under many working conditions which permit putting the wheels part way up the bank the slope can be made still steeper. The standard 12-ft. blade can be extended horizontally beyond the line of wheels approximately 6 ft., and the 14-ft. blade approximately 8 ft. These measurements can be increased an additional 3 ft. by the use of a standard moldboard extension. Such a wide reach permits the finishing of shoulders or berms on contract work without getting the grader off of the pavement. A front tilting adjustment on the semicircle permits a wide range of blade pitch adjustments. Control is through an inclosed worm and gear operated from the platform.

One of the high points of construction is the frame, which consists of two heavy ship channels cross-connected by five large tubular members securely welded to the frame beams. The front truck is connected to the grader by a large machine-finished steel ball-and-socket joint, which permits absolute freedom for oscillation. The drawbar is of heavy H-beams and is attached just above the draft ball by a universal eye connection. A heavy semicircle, which gives wide support to the moldboard, is closely fitted to the reversing circle. Both are of all-welded construction.

Every gear on the machine is inclosed. Gears are machine cut from forged steel blanks and worms from semi-steel blanks; all worms are fitted with Timken roller bearings for end thrust. All connections in the blade and scarifier controls, blade side-shift and semicircle tilting adjustments are of the machine-finished ball-and-socket type, Alemite lubricated and fully adjustable for wear. Lift links and other connecting links are drop-forged steel. Connections to the moldboard are also of the ball-and-socket type.

Grader cutting steep bank

The new grader is available in two sizes, with 12- or 14-ft. blade and 8-, 9- or 10-ft. blade. Either grader is offered with or without scarifier.

Centrifugal Tube-Lining Process

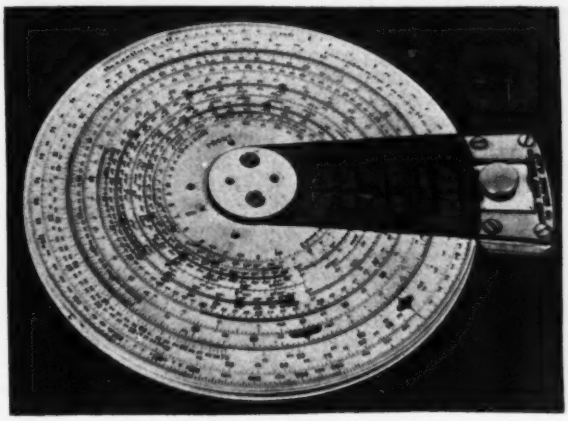
A new centrifugal method of lining steel tubing with a variety of metals or alloys has been announced by the Detroit Seamless Steel Tubes Co., Detroit, Mich., which has secured exclusive patent rights to the process. Of particular importance in the application of this new process to industrial uses is the fact that in combining the inner lining metal with the outer steel shell the two are bonded by fusion so inseparably that there is not only no evidence of separation but no manual means of destroying the union. In fact, according to the company, turnings made from the end of a tube so lined will curl off the tool so integrally united that the spiral formed shows both textures of the bonded metals as one continuous strip without fracture at any point between the two. Further demonstrations of the completeness of fusion have been obtained, in cases where the linings were of malleable metals, by splitting and rolling the finished tubes into flat sheets which still retained their respective layers in proper comparative thickness,

inseparably bonded together. In other tests the combination has been manipulated or worked into various forms, even to the extent of turning it "wrong side out" without destroying the union in any way.

Practical uses to which the lined tubing may be put cover a wide range, including its use for steel-backed bearings, for conveying corrosive liquids, in water tube boilers and for water pipes where strength is an essential factor.

Pocket-Size Circular Slide Rule Has 50-In. Scales

By coiling the scales four times around concentric disks J. R. Dempster, 2204 Glen Ave., Berkeley, Calif., has succeeded in producing the equivalent of a 50-in. slide rule in an instrument small enough to be carried in the coat pocket. The circular construction also eliminates the annoyance of running off the end experienced with straight rules. Both sides of the instrument, which is



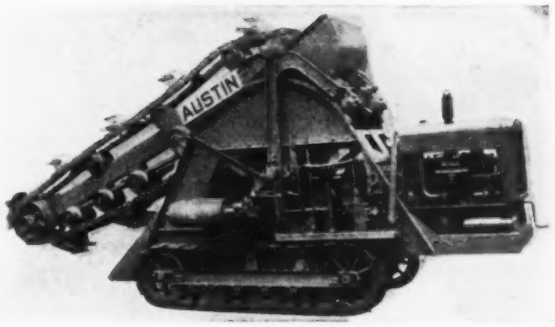
Circular slide rule

constructed of white celluloid, are used for scales, which permit reading results to four decimal places. For rapid multiplication and division, a set of 13-in. scales is also provided. Provision is made for taking up play or wear between the disk and the ring, and for adjusting the friction. The runner pivots on a ball-bearing center and has a clamping device at its outer end. All the usual scales are provided, including log-log, inverted, and 17-in. trigonometric scales giving all six functions. Special scales available include a stadia reduction scale and one for solving the equation $\sqrt{x^2 + y^2}$ in one setting.

Camelback Type Bucket Ditcher

Digging trenches for small sewers and pipelines is the function for which the Austin Machinery Corp., Muskegon, Mich., has brought out a model TS trench machine of an unusual type. As is shown by the illustration, the general appearance of main frame presents a camelback construction, with a wide throat clearance for the excavator bucket line. The boom is mounted on a carriage located on top of the frame. When not in operation, the boom is carried forward over the machine, making a compact machine for transportation.

The trencher is mounted on two large multi-pedal traction which provide ample bearing area for traveling over soft ground. These treads are hinged to the main frame at the front end and are connected to an equalizing bar at the rear. Each one is driven independently through friction clutches. Power for the machine is provided by a model VU-3 Waukesha four-cylinder gasoline motor developing 35 hp. at 1,200 r.p.m. A Twin Disc clutch power take-off is standard equipment. A full ball-bearing oiltight case houses the two-speed-and-reverse gear unit, which is connected to the power unit through a flexible coupling. Gears are of stub tooth construction, machine cut, and operate in an oil bath. In addition, there is a three-speed transmission, also fully inclosed, which in combination with the main gear units provides six direct digging speeds without changing sprockets or gears. Channel sections form the framework of the 8-ft. boom, which is raised and lowered by power through friction clutches, a self-locking worm gear, and a sprocket engaging a rack on the upper main frame. The conveyor is fully reversible and can be shifted from one side to the other. The 20-in. four-ply canvas belt is impregnated with rubber.



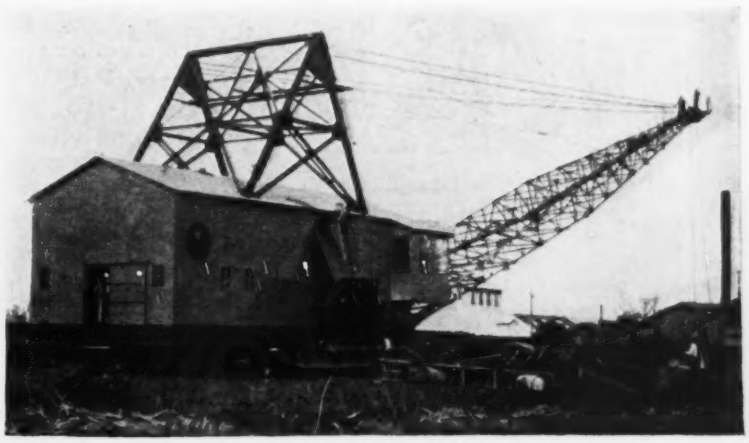
Bucket excavator in traveling position

Standard bucket equipment is one set of 12-in. buckets to dig 12, 14 and 18 in. wide; 16-in. buckets to dig 16, 18, 22 and 26 in. wide; or 22-in. buckets to dig 22, 26 and 30 in. wide. These units are of annealed high-carbon cast steel with lips and bucket hangers cast integral with the buckets.

Walking Dragline Carries 8-Yd. Bucket on 160-Ft. Boom

What is said to be the largest walking dragline excavator ever manufactured will soon be placed in service on a levee construction project on the Mississippi River near Cape Girardeau, Mo. This machine, known as model 8160 of the Monighan Mfg. Corp., now known as the Bucyrus-Monighan Corp., Chicago, Ill., is equipped with a 160-ft. boom and carries an 8-cu.yd. dragline bucket. Its total weight of 550 tons is distributed over a circular base 36 ft. in diameter, giving a unit ground pressure of only 7 lb. per sq.in. The machine is self-propelling, using the well-known Monighan walking principle, by which the weight of the superstructure is transferred from the circular operating base to two all-steel pontoons or shoes, one on each side of the revolving frame. The mechanism which operates and con-

(Continued on page 712)



8-cu.yd. dragline with 160-ft. boom

Current Construction Unit Prices

Concrete Paving in Wilmette

CONTRACT was let March 31, 1931, by the board of local improvements on 90,600 sq.yd. on Elmwood Ave., Wilmette, Ill. The lowest bid was $1.85, the contract price was $1.88, and all the other seven bids were below $2.01. The low price of $210,553 was 5½ per cent below the average, 9 per cent below high and 40 per cent below the engineer's estimate.

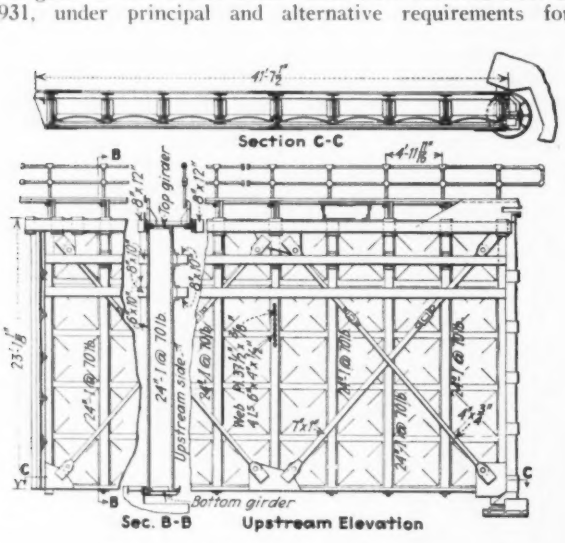
Unit prices are given of the lowest three bidders: (A) Arcole Construction Co., Niles Center, Ill. (contract); (B) H. G. Goelitz Co., $213,734; (C) W. A. Black Co., $214,988.

	A	B	C
52,500 cu.yd. earth	$0.32	$0.25	$0.40
90,600 sq.yd. conc. pave	1.88	1.95	1.85
60,350 lin.ft. conc. curb	.18	.20	.21
39 brick valve chambers	.65	.60	.67½
13,350 sq.ft. conc. walk	.25	.25	.25
268 manhole covers	3.00	4.35	4.65
1,100 lin.ft. plank headers	.18	.05	.50
75 tons ½-in. round steel rods	53.00	46.00	56.25
25 lin.ft. conc. curb removed	.10	.30	.25
1,040 lin.ft. 8-in. tile valve-chamber connections	.75	.65	.90
3,100 lin.ft. concrete duct	.30	.27	.25
Totals	$210,553	$213,734	$214,988

Lock Gates at Great Bridge, Va.

TIDAL lock gates are to be constructed at Great Bridge, Va., in Albemarle and Chesapeake Canal in connection with the inland waterway between Norfolk and Beaufont Inlet, N. C. There will be either two, four or five complete lock gates of two leaves each. Bids were received Feb. 6, 1931, under principal and alternative requirements for structural steel. The alternate is structural steel with copper. There are three proposals: A, four gates of two leaves each, complete with all fittings; B, two gates complete, including all fittings necessary to be placed in the concrete gate abutments for two more gates; C, five gates with fittings for four, but for the fifth gate only those fittings that are a part of the movable leaves and necessary for their installation as spares. Time of completion on each proposal is as follows: 120 days for pintle shoes, quoin shoes, curb angles, bearing castings at quoin, and wedges for four gates; two gates in 120 days; remaining two gates of proposal A and C in 180 days.

Complete unit prices are given for proposal A, both plain and with copper. Capt. H. B. Vaughan, Jr., is executive officer, U. S. Engineer Office, Norfolk.



Design of lock gate, Great Bridge, Va.

Paving in Santa Clara, Calif., 1929-31

CONTRACT unit prices are given herewith on eighteen asphaltic concrete paving jobs let in Santa Clara, Calif., since April, 1929. Average total price is $54,400, and the number of bidders ranged from two to twelve and averaged six. The prices include grading, laying 3 in. of cushion, 3 in. of asphaltic concrete and 2- or 3-in. asphaltic surface. Cushion consists of a mixture of sand, gravel and not more than 30 per cent clay. G. L. Sullivan, city engineer, furnished the data.

	Sq. Ft.		Bid Per Sq. Ft.		
Location of Street	5 in.	6 in.	5 in.	6 in.	Awarded
Main and Bank Sts.	19,215	43,500	15.5	17.5	Apr. 22, '29
Franklin and Sherman	42,400	67,900	15.6	17.5	Apr. 22, '29
Lincoln St.	.....	78,840	.....	20.	.....
Lincoln St.	31,260	.....	18.	.....	Apr. 22, '29
Main and Monroe Sts.	298,000	31,840	16.4	18.	July 16, '29
Washington and Jackson	.....	.....	20.1	22.2	.....
Washington and Jackson	282,200	46,000	16.75	18.	Aug. 20, '29
Lafayette St.	.....	170,200	.....	15.5	Dec. 18, '29
Madison and Jefferson	491,300	85,900	13.75	15.75	Dec. 18, '29
Benton, Liberty, etc.	390,000	283,500	16.25	18.7	.....
Benton, Liberty, etc.	390,000	283,500	13.3	16.	Feb. 3, '30
Union Avenue	.....	128,000	.....	16.	.....
Union Avenue	.....	6,000	.....	19.4	June 23, '30
Santa Clara Market	491,000	.....	12.1	.....	Feb. 2, '31
Santa Clara Market	5,400	.....	19.6	.....	.....
Lewis-Harrison	516,000	19,000	12.1	13.77	Feb. 2, '31
Bellomy and Campbell Ave.	.....	76,000	.....	12.75	Feb. 16, '31
Lexington and Main	64,000	126,000	12.1	13.77	Feb. 2, '31

Refuse Incinerators for District of Columbia

TWO high-temperature refuse incinerators are to be built in the District of Columbia. One is to be located at K and 31st Sts., Northwest, Georgetown, and the other at O and First Sts., Southeast. The incinerators will receive combustible refuse, street sweepings and other rubbish, but not manure or waste material from building operations, as earth, sand, brick, stone and plaster.

The Georgetown plant will have two units, each capable of burning 85 tons per day. The O St. plant will have five of these units. The work consists of the construction of these incinerators, including buildings and equipment.

At each plant trucks drive onto a dumping floor and

COMPLETE BIDS ON PROPOSAL A, LOCK GATES AT GREAT BRIDGE, VA., GUARD LOCK

Bidders	Structural Steel, Plain				Structural Steel, With Copper			
	Fittings	1 Gate	4 Gates	Total	Fittings	1 Gate	4 Gates	Total
Berkeley Machine & Foundry Co., Inc., Norfolk, Va.	10,052	11,737	46,948	57,000	10,052	12,137	48,548	58,600
Independent Bridge Co., Neville Island Branch, Pittsburgh, Pa.	8,400	15,000	60,000	68,400	8,400	15,300	61,200	69,600
Elizabeth City Iron Works & Supply Co., Elizabeth City, N. C.	.....	13,600	54,400	54,400	.....	15,300	60,000	60,000
Dravo Contracting Co., Neville Island Station, Pittsburgh, Pa.	7,720	20,260	81,040	88,760	7,775	20,550	82,200	89,975
Nashville Bridge Co., Nashville, Tenn.	5,849	16,249	64,996	70,845	5,900	16,549	66,196	72,096
Roanoke Iron & Bridge Works, Inc., Roanoke, Va.	.....	.....	.....	69,000	.....	.....	.....	71,000
Newport News Shipbuilding & Dry-Dock Co., Newport News, Va.	8,900	15,600	62,400	71,300	8,900	15,900	63,600	72,500
Penn. Bridge Co. of America, Beaver Falls, Pa.	6,100	15,400	61,600	67,700	6,155	15,650	62,600	68,755
Hampton Roads Shipbuilding Corp., Portsmouth, Va.	13,540	14,615	58,460	72,000	13,540	14,807	59,228	72,768
Virginia Bridge & Iron Co., Roanoke, Va.	10,350	18,112	72,450	82,800	10,350	18,400	73,600	83,950
Norfolk Navy Yard, Portsmouth, Va.	.....	.....	.....	96,000	.....	.....	.....	96,500
Average	$8,850	$15,600	$62,500	$72,500	$8,900	$16,000	$64,200	74,200

	A	Per Cent of Total Cost	B	Per Cent of Total Cost
O St. Plant				
Complete	$399,000	100	$401,636	100
Equipment	129,800	33	179,543	45
Buildings	240,700	60	190,317	47
Chimneys	24,000	6	27,750	7
Grading and driveways	4,500	1	4,026	1
Georgetown Plant				
Complete	181,000	100	197,681	100
Equipment	44,300	25	78,200	39
Buildings	118,300	65	104,883	53
Chimneys	11,000	6	12,900	7
Grading and driveways	7,400	4	1,698	1
O St. and Georgetown Plants				
Both plants, complete	574,000	...	598,317	...
O St. Plant				
Complete	395,000	...	398,436	...
Equipment	127,800	...	178,543	...
Buildings	239,700	...	188,117	...
Chimneys	23,000	...	27,750	...
Grading and driveways	4,500	...	4,026	...
Georgetown Plant				
Complete	179,000	...	195,881	...
Equipment	43,300	...	77,700	...
Buildings	117,800	...	103,583	...
Chimneys	10,500	...	12,900	...
Grading and driveways	7,400	...	1,698	...
Time of Completion				
O St. Plant	Dec. 1, 1931	...	Jan. 17, 1931	...
Georgetown Plant	Oct. 1, 1931	...	Nov. 17, 1931	....
O St. and Georgetown Plants				
O St. Plant	Dec. 1, 1931	...	Jan. 17, 1932	...
Georgetown Plant	Oct. 1, 1931	...	Nov. 17, 1931	...

dump into a reinforced-concrete receiving bin. The bin at Georgetown is to have 25,000-cu.ft. capacity; the O St. bin, 50,000 cu.ft. Furnaces are charged by a traveling crane through pneumatically operated charging doors. Ashes are removed from the pits directly into an ash tunnel.

The building foundation and foundation walls are 1:6 reinforced concrete. The superstructure is of brick and steel. Minimum live loads are 350 lb. for dumping-room floor and 200 lb. for charging and stoking-room floors.

The furnaces in each plant are built in one row, and each unit may be operated separately. They may have either brick walls with refractory linings or steel water jackets covered with heat-insulating material. The brick walls outside the refractory linings are 12 in. thick. All furnaces, combustion chambers and flues have suspended arches supported independently of the refractory walls. Each furnace may have several separate grates or cells, with independent charging and cleaning provisions. Total volume of each furnace, exclusive of ashpits, is 720 cu.ft., and in addition each has a separate combustion chamber of 2,150 cu.ft. Minimum cross-sections of flues are 60 sq.ft. for those serving one furnace, 85 sq.ft. for two furnaces and 100 sq.ft. for three furnaces.

Chimneys (one at Georgetown and two at O St.) have a minimum height of 150 ft. and an internal diameter of 9 ft., at Georgetown plant, and 10 ft. at O St. They are built of perforated radial red brick, and have sectional ring linings of firebrick 4½ in. thick.

Bids were received March 17 from eleven companies, and prices are given of the lowest two: A, Superior Incinerator Co. and L. E. Meyers, Dallas, Tex.; B, Morse-Boulger Destructor Co., New York. Prices are on each plant separately and on the two in combination. The lowest bid of $574,000 was for the two, and was 22 per cent below the average of $733,300.

Deepening St. Marys River, Michigan

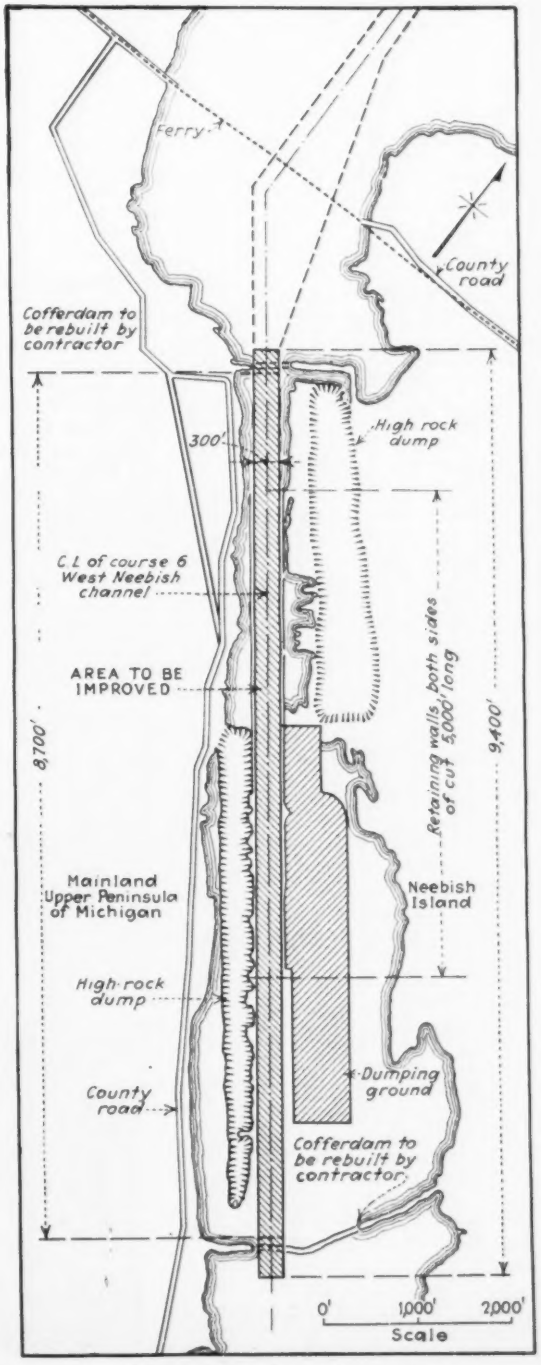
CONTRACT was let in March, 1931, by the U. S. Engineer Office at Detroit for deepening course 6, rock cut, West Neebish channel, St. Marys River, Mich. The price was $790,415, which was 5 per cent below the price of the second bidder and 32 per cent below the average of the thirteen bids.

The work is located in St. Marys River 18 miles downstream or south of the locks at St. Marys Falls Canal. It consists of providing a minimum depth of 27 ft. below low water datum over a 300-ft. width and for a distance of 9,400 ft. The area to be improved is 313,000 sq.yd., of which 290,000 is dry excavation. Range in water level is 1 ft. and current is 3 miles per hour.

Quantity of material exclusive of overdepth and side slopes is 320,400 cu.yd.; side slope excavation, 25,000; overdepth, 193,800. Material is sand, gravel, clay, boulders, loose and ledge rock. The two other items of the work consist of repairing 1,000 sq.yd. retaining wall surface, and cofferdam construction. The top of the walls is 6 ft. above the plane of reference of low water, and is 5 ft. wide. Face is vertical and back has a batter of not less than 3 vertical to 1 horizontal. There are two breaks: one 300 ft. long by 15 ft. deep and the other 200 ft. by 6 ft. The three cofferdams will require 61,000 cu.yd

Unit prices are given of the lowest three bidders: A, Connolly Contracting Co., 2234 University Ave., St. Paul (contract); B, S. J. Groves & Sons Co., Minneapolis; C, Peppard & Fulton Co., Minneapolis.

	A	B	C
Excavation, cu.yd	$1.37	$1.457	$1.55
Repair Walls, sq.yd	11.00	10.00	7.50
Cofferdam (lump sum)	191,000.00	200,000.00	250,000.00
	$790,415	$832,775	$923,225



Layout of St. Marys River project

8-Yd. Walking Dragline

(Continued from page 709)

trols the walking device consists of only six major working parts. The direction of motion is controlled by the swinging control of the machine.

The new dragline incorporates such modern features as roller bearings in high-speed shafting supports, direct roller bearings in part of the drive taking end thrust, peak and bucket padlock shift bearings, to eliminate excessive friction at these points. Variable voltage electric control of the Ward-Leonard type controls the swinging function, and can also be fitted to other mechanisms if desired. The power plant consists of a two-cycle, full-diesel five-cylinder engine equipped with separate scavenging cylinder, oil-cooled pistons, continuous pressure lubricating systems, centralized controls, and special oversize ball thrust bearings at flywheel end of the crankshaft.

Centrifugal Dredge Pumps

Water containing abrasive substances, when passed through a centrifugal pump, often causes rapid wear which results in a marked drop in efficiency, the need for frequent repairs, and a low limitation on discharge pressures. To overcome these difficulties the Allen-Sherman-Hoff Co., 217 South Fifteenth St., Philadelphia, Pa., has developed the Hydroseal dredge pump, a unit basically similar to the standard centrifugal pump, but different in several notable features. The main point of distinction is the use of clear water at low pressure to protect the impeller and casing from wear, thus maintaining the efficiency of the unit and reducing leakage and abrasion on the sealing ring and gland. In addition, pump bearings are so located that there is almost no shaft overhang, so that the peripheral speed of the impeller can be increased far above the ordinary limit. Because of this and of the fact that leakage at the sealing ring is unaffected by the discharge head of the pump, it is practicable to produce pressures as high as 150 lb. per sq.in. and still maintain high efficiencies.

Operation of the pump can best be explained by reference to the diagram. As in the standard centrifugal pump, abrasive-laden liquid enters the suction at *A*, passes through the impeller *B*, thence through the volute *C* to the pump discharge. Clear water at a low relative pressure is brought to the unit through piping *D* and is introduced into chambers *E* and *E'*. Due to the adhesion of this water to the side surfaces of the impeller and because of the close clearances at points *F* and *F'* the initial pressure of this clear water is boosted above the pressure in the main volute *C*. Thus the annular clearances *F* and *F'* are continuousy filled with clear water flowing into the volute *C*, rather than with abrasive-laden material water flowing in the opposite direction. It can readily be seen that leakage through sealing ring *H* is of low-pressure clear water only,

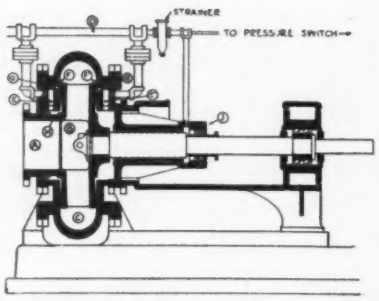


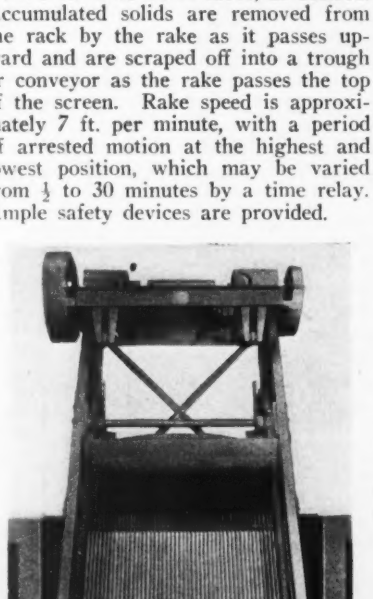
Diagram of dredge pump elements

so that the efficiency of the sealing ring is maintained. Also, the gland *J* is subjected merely to low-pressure clear water rather than to the high-pressure "gland" water sometimes used.

Another notable feature of the Hydroseal pump is the use of electric alloy steel castings of a special alloy known as Ashcolite in pump shell and impeller. Models are available for either horizontal or vertical mounting.

Sewage Screen With Cleaner

Strength and power sufficient to handle very heavy solids without damage are the features of a straight-line screen for sewage which has been announced by the Link-Belt Co., 2045 West Hunting Park Ave., Philadelphia, Pa. The mechanism consists of a rack made up of steel bars $\frac{5}{8}$ in. or more apart and of a rake secured to a carriage which travels back and forth over the screen bars. The width of a unit may vary from 3 ft. to 15 ft. or more, as desired. Accumulated solids are removed from the rack by the rake as it passes upward and are scraped off into a trough or conveyor as the rake passes the top of the screen. Rake speed is approximately 7 ft. per minute, with a period of arrested motion at the highest and lowest position, which may be varied from $\frac{1}{2}$ to 30 minutes by a time relay. Ample safety devices are provided.



Screen and rake for sewage plant

New Publications

Reinforcing Bars—Bending and tension tests bringing out the unusual ductility of reinforcing bars made by SWEET'S STEEL Co., Williamsport, Pa., are outlined in a 4-page pamphlet issued by that company.

Metal Curbing and Pipe—Pamphlets describing spiral welded pipe and a new metal curb and tie-rod design for highway construction have been issued by the AMERICAN ROLLING MILL Co., Middletown, Ohio.

Welding—Copper welding by the Premag process is explained in an 8-page bulletin issued by MUREX WELDING PROCESSES, LTD., Forest Road, London, E. 17, England.

Grading Equipment — Baker Maney Scrapers, rotary scrapers and road rooters are described and illustrated in a 32-page bulletin No. 295 of the BAKER MFG. Co., Springfield, Ill.

Bituminous Pavement—Methods of applying Tarvia A and B, Tarvia Retread and Tarvia-Lithic are outlined in three recent bulletins published by THE BARRETT COMPANY, 40 Rector St., New York City.

Diesel Motors—Full information regarding the speed record of 100.755 miles per hour made by C. L. Cummins at Daytona Beach, Fla., with a standard marine diesel engine, mounted in an automobile chassis, are given in a circular issued by the CUMMINS ENGINE Co., Columbus, Ind.

Road Machinery—Catalog 31 of the J. D. ADAMS Co., Indianapolis, Ind., covers the complete line of road machinery manufactured by this company, including several new machines classified as leaning wheel graders, tandem drive motor graders, a trailer patrol and a retread mixer. The catalog contains 48 pages and is fully illustrated.

Testing—Research families of the PITTSBURGH TESTING LABORATORY are the subject of a 14-page bulletin discussing specialized services available for research leading to product development, improvements, modern marketing and special investigation. It may be obtained from the laboratory at Pittsburgh, Pa.

Concrete—"Concrete Facts for Concrete Contractors" is a new 48-page booklet which has been published by the PORTLAND CEMENT ASSOCIATION, 33 West Grand Ave., Chicago, Ill. It deals with concrete making, including facts on colored concrete, special surface finishes, forms, watertight concrete and cold weather construction. The methods described are thoroughly practical and are being used by an increasing number of present-day contractors.

Drilling—CLEVELAND ROCK DRILL Co., 3734 East 78th St., Cleveland, Ohio, has issued a 122-page pocket-size illustrated volume, "The Driller's Handbook," compiled by E. L. Oldham and selling at $1 per copy. This is designed for the use of drill operators and takes up the subjects of lubrication, operation, shanks and bits, hose and couplings, modern rock drill types and explosives and blasting. Many illustrations are included.

Construction Equipment—Three new construction equipment catalogs dealing with Rex equipment are now being distributed by the CHAIN BELT Co., Milwaukee, Wis. Catalog 204 deals with building mixers, pumps, saw rigs and plaster and mortar mixers. It contain 64 pages. The Champion paver and road pump is described in catalog 206, 36 pages. "Rex Concrete Factories" is the title of catalog 205, which deals with three types of concrete factories—wet, dry and shrinkage.

Concrete Construction—CONCRETE REINFORCING STEEL INSTITUTE, Tribune Tower, Chicago, Ill., has issued a code of standard practice for concrete joist construction and floor forms. The code is intended to govern conditions not covered by engineers' and architects' plans and specifications, and also gives valuable information as to practices which are standard within the industry and which may be used to decrease the cost of floor design when either metal or wood filler forms are used.

Scraper Mucking—A comprehensive discussion of the use of scraper mucking in mines is contained in a 118-page illustrated booklet issued by the SULLIVAN MACHINERY Co., 400 North Michigan Ave., Chicago, Ill., at $2 per copy. The book is divided into two major sections, the first half being devoted to an analysis of the elements and the setting up of general principles of scraper mucking, while the second half contains descriptive matter collected and condensed from previously published articles illustrating applications of the principles.

CONSTRUCTION NEWS

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Some of the Week's Large Projects

For further details turn to the appropriate sections in this issue.

Location	*Project*	*Cost*	*Status*
Waterworks			
San Francisco	Water pipe Line	$5,000,000	Bids asked
Boston	Water tunnel	$4,978,031	Contract
Salt Lake City	Pumping plant, mains, etc.	2,000,000	Proposed
Dams			
Burnet (Tex.)	Dam	6,000,000	Contract
Subways and Tunnels			
Philadelphia	Subway	3,885,629	Contract
Grade Crossings			
Herkimer (N.Y.)	Grade Crossing	2,665,600	Proposed
Piers and Wharves			
Marquette (Mich.)	Ore dock	1,300,000	Contract
Factories and Mills			
Los Angeles	Sugar refinery	2,000,000	Proposed
El Paso (Tex.)	Rod mill and copper wire plant	1,500,000	Proposed
Warehouses			
Pittsburgh	Warehouse, etc.	4,000,000	Proposed
Power Plants			
Galveston	Electric plant, etc.	986,500	Proposed
Buildings			
San Antonio	Athletic club	1,000,000	Proposed
Worcester (Mass.)	Hospital	1,000,000	Bids asked
Elizabeth (N.J.)	City Hall	1,000,000	Proposed
Brooklyn	Fire department	2,000,000	Proposed
Newark (N.J.)	School	1,000,000	Proposed
New York	Trades school	2,100,000	Proposed
Boston	Publishing plant	3,000,000	Proposed

WATERWORKS

PROPOSED WORK

Mass., Barnstable—Town, storage reservoirs to supply Barnstable Fire Dist. $15,000. P. M. Swift, secy. Firt Comr. Engineer not selected.

Mass., Reading—Town, Dpt. P. Wks., pumping station. $50,000. Weston & Sampson, 14 Beacon St., Boston, engrs.

Mich., St. Joseph—Pumping station, filtration plant for waterworks, with connections, appurtenances, $175,000 Gordon & Bulot, 53 West Jackson Blvd., Chicago, Ill., consult. engrs.

N. H., Keene—Clearing basin, constructing 675 ft. concrete, stone dam, 30 ft. high, at Roaring Brook, Roxbury. $50,000. Owners clear site. Weston & Sampson, 14 Beacon St., Boston, Mass., engrs. Noted Apr. 2.

Pa., Bedford—Boro waterworks, probably consist of piping water from Bedford Springs. **Maturity about August.** L. Blackburn, city clk. Engineer not selected.

Tex., Taylor—City waterworks improvements, incl. concrete reservoir, etc. Hawley, Freese & Nichols, 417 Capps Bldg., Fort Worth, consult. engrs. Noted Jan. 8.

Utah, Salt Lake City—For 21,000 ft. 42 in. concrete pipe, developing artesian basin, incl. pumping plant, 30,000 ft. 20- to 36-in. welded steel and concrete pipe, 1 m.g. steel tank. $2,000,000. H. Jessen, c/o City and County Bldg., engr.

Washington—Mountain Lakes Water Co., Central Bldg., Seattle, preliminary plans water system to supply district between Seattle and Everett. T. F. X. Davaney, of New York, pres.

BIDS ASKED

Calif., San Francisco — May 6, by S. J. Hester, secy. Bd. P. Wks., constructing San Joaquin Valley Pipe Line in San Joaquin Div. of Hetch Hetchy Aqueduct, under Hetch Hetchy Contr. 123, incl. 47.5 mi. 59- to 70-in. steel pipe riveted or Lockbar and welded; rein.-con., alternate for Sect. C only, for City and San Francisco Co. To exceed $5,000,000. M. M. O'Shaughnessay, city clk. Noted Apr. 9.

Calif., Ventura — May 5, by Bd. Supervs. Ventura Co., furnishing, installing direct connected motor driven deep well turbine pump and motor, pump with top of bowls set with 120 ft. below ground, 40 hp. motor, 100 ft. 10 in. discharge casing pipe from pump to bank.

Ind., Valparaiso—May 1, by City Council, waterworks improvements, incl. 500,000 gal. storage tank, 14 in. feed line. $125,000. A Schenck, mayor.

Mass., Falmouth—Apr. 30, by G. A. Griffin, Bd. Water Comrs., furnishing, installing pumping equipment, appurtenances. Metcalf & Eddy, 1300 Statler Bldg., Boston, engrs. Noted Mar. 5.

N. Y., New York—Apr. 28, by J. J. Dietz, comr. Water Supply, Gas & Electricity, Municipal Bldg., mains in Pelham Parkway, East 215th St., Shore Dr., Polo and Twiggs Pls., Croes, Fairfield, Fteley, Lacombe, Longstreet, Murdock, Nereid, Paulding, Radcliffe, Randall, Vincent and Whitlock Aves., Bronx Boro.

N. Y., Ogdensburg—May 6, by Dpt. Mental Hygiene, State Office Bldg., Albany, water pump, tank for Reception Hospitals, St. Lawrence Hospitals; adv. E. N.-R. Apr. 23.

Wash., La Conner—City Council bids about June 30, waterworks, incl. 200,000 gal. reservoir, laying 25,000 ft. 6 in. pipe. $40,000. W. C. Morse, Inc., Smith Tower, Seattle, engr.

Wash., Seattle—May 1, by Bd. P. Wks., City Hall, 75 m.g. reservoir and two 1 m.g. standpipes. $775,000. R. H. Thomson, city engr. Noted Mar. 26.

CONTRACTS AWARDED

N. J., Trenton—State Bd. Educ., State House, water supply to A. N. Bugbee, 586 Bellevue Ave., $39,721; electrical system, to Carr & Schultz, Stockton and Perry Sts., $23,928; sewerage system, to Hart Eng. Co., 301 Madison Ave., New York, $29,535; steam distribution, to Mechanical Equipment Co., Drexel Bldg., Phila., Pa., $58,782. Grand total $151,966.

N. Y., New York—J. J. Dietz, comr. Water Supply, Gas & Electricity, Municipal Bldg., mains in Bryant Ave., to L. D. Gregory, 158 26th St., Brooklyn, $14,822. Noted Mar. 26.

Pa., Phila. — Dpt. P. Wks., Bureau Water, City Hall Annex, A. Murdock, dir., Contr. 972, spiral riveted pipe, to Standard Piping & Filtering Co., 49th St. and Grays Ave., $4,680; Contr. 1004, furnishing, installing 6 pilot tubes meter, to Simplex Valve & Meter Co., 68th St. and Upland Ave., $4,950; Contr. 1018, high press mains, to P. and A. J. Ellis, 4th and Wyoming Sts., $27,935. Grand total $37,565. Contr. 1007 will be re-advertised.

S. D., Huron—City Clerk, 300,000 gal. elevated steel tank, to Pittsburgh-Des Moines Steel Co., Tuttle and Southwest 10th Sts., Des Moines, Ia., $17,000. Noted Feb. 19.

Ont., Aylmer—Town, drilling deep well, installing pump with gasoline and electric drives, to Layne Canadian Water Supply Co. Ltd., Metropolitan Bldg., Toronto. Est. $15,000.

Ont., Lucknow—Town, stand pipe in connection with waterworks, to Toronto Iron Wks., Eastern Ave., Toronto, $7,300; foundations for standpipe to R. Mowbray, White Church, $1,035; drilling Well 1, to Layne Canadian Water Supply Co., Metropolitan Bldg., Toronto, $11,250. Grand total $19,585.

SEWERS

PROPOSED WORK

Ark., Blytheville—Preliminary plans sewerage system in Sewer Impvt. Dist. 3, $70,000. J. W. Meyer, 201 Lynch Bldg., engr. Noted Mar. 26.

Calif., Burlingame—City Council sewage disposal plant, pumping station. To exceed $25,000. C. M. Thomas, city engr.

Calif., Capitola — Capitola Sanitary Dist., sanitary sewerage system. To exceed $30,000. W. H. Oliver, San Jose Rd. and Soquel St., Santa Cruz, engr.

Conn., New Britain—City reinforcing sanitary sewer line and new 27 in. pipe line Fairview Cemetery and Christian Lane. $30,000. W. Merian, City Hall, engr. Morris Knowles, Inc., Westinghouse Bldg., Pittsburgh, Pa., consult. engrs.

Ind., Bloomington—City Council Jordan River Storm Sewer. $75,000. Address City Clerk.

Ia., Burlington—Preliminary plans sewer extension to Mississippi River. $60,000. H. A. Vollmer, City Hall, engr.

N. J., Fairview—Bd. Boro Council, Tiger Hose Fire House, altering sewage disposal plant. $25,000. Project in abeyance. F. Oleri, 650 Bergenline Ave., West New York, boro engr. Noted Apr. 2.

N. J., Long Branch—Bd. City Comrs., City Hall, preliminary plans constructing, extending sanitary sewers. $450,000.

Okla., Oklahoma City—Preliminary plans sanitary lateral sewers in east half Crowne Heights addition. $45,000. G. F. Brown, City Hall engr.

Ont., Hamilton—City, ¼ mi. probably concrete trunk sewer on Royal Ave., from Strand's Lane to Emerson St. $56,000. W. L. McFaul, City Hall, engr.

BIDS ASKED

Ill., Aurora — May 19, by Bd. Trustees Aurora Sanitary Dist., 2.5 mi. 8- to 30-in. sewers. Engineering Service Co., 59 South La Salle St., engrs.

Ill., Downers Grove — May 19, by Bd. Trustees Downers Grove Sanitary Dist., 5106 Main St., enlarging sewage treatment works. A. F. Brevillier, pres.; adv. E. N.-R. Apr. 23.

Ia., Cedar Rapids—Apr. 30, by L. J. Storey, city clk., West Side Sanitary Sewer Incepter, Sect. A, 605 ft. 27 in. cradled vitr. sewer, 2,604 ft. 42 in. and 240 ft. 48 in. concrete or segmental block sewer, 300 ft. 48 in. corrugated iron river outlet, 6 standard manholes, 4 special manholes: Sect. B, two 30 in. c.i. river crossings, 240 ft. on bank, 335 ft. across river, 2 large control manholes: Sect. C, 36 x 72 ft. pumping plant, buttressed concrete below flood line, brick and concrete above line; Sect. D, furnishing, supervising installation two 8,800 g.p.m., one 500 g.p.m. and one 200 g.p.m. pumps; Sect. E, electrical work in and around pump house. Howard R. Green Co., 208-10 Bever Bldg., engrs. Noted Feb. 19.

Mass., Milford—See "Contracts Awarded."

Mass., Boston—Apr. 24, by Dpt. P. Wks., J. A. Rourke, comr., sewerage works in Butler St., Dorchester. $25,000.

Mass., Boston—Apr. 28, by Dpt. P. Wks., J. A. Rourke, comr., sewerage works in West Roxbury; Apr. 29 in Roxbury. $25,000.

Mass., Boston—Apr. 28, by Dpt. P. Wks., sewerage works in streets in Dorchester, and Apr. 30 in West Roxbury, est. $25,000; May 1, in various streets and playground, Dorchester, $25,000; Apr. 30, in Hyde Park, and May 1, Roxbury, $25,000. J. A. Rourke, comr.

See proposal advertising on page 105

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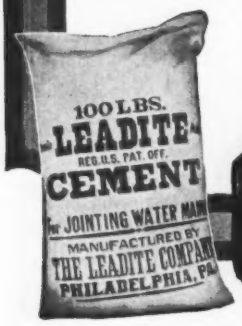

No Caulking

Sewers (Continued)

N. Y., Long Island City—Apr. 27, by G. U. Harvey, pres. Queens Boro, Queens Subway Bldg., sewers in Utopia Parkway, 34th, Quencer and 111th Rds., 39th, 38th, 35th, 34th, 38th, 39th, 45th, Braddock, 108th, 144th, Hollis, 100th, Liberty, Sutter Ave., 71st, 209th, 210th, 211th, 213th, 206th, 205th, 204th, 189th, 243rd, 241st, 242nd, 145th, 148th, 174th, Newburg Sts.

O., Garfield Heights (br. Cleveland)—Apr. 27, by City 6,000 ft. 18- to 48-in. concrete, vitr. clay or segmental block sewers in Impvt. 11, Sects. 1 and 2. R. Munz, City Hall, engr.

Pa., Midland—May 1, by Bd. Control, 4,200 ft. storm and sanitary sewers. $30,000. R. Steebner, City Hall, engr.

Tenn., Memphis—Apr. 28, by City Council, at office D. C. Miller, city clk., Hollywood and Driving Park Sewers. W. B. Fowler, city engr.; adv. E. N.-R. Apr. 23.

CONTRACTS AWARDED

Calif., Los Angeles—Bd. P. Wks., City Hall, sanitary sewer, house connections in 114th St. and Monitor Ave. Sewer Dist., to Radich & Granich, 410 North Formosa St., $149,845. Noted Mar. 26.

Calif., San Francisco—S. J. Hester, secy. Bd. P. Wks., Sect. B, 15th Street Sewer, incl. 4,000 lin.ft. 7 ft. to 3 ft. x 4 ft. 6 in. rein.-con. sewer, to Healy-Tibbitts Constr. Co., 64 Pine St., $113,680. Noted Mar. 19.

Md., Baltimore—Bd. Awards, sanitary sewers in Sanitary Sewer Contr. 264, to J. Matricciani, 229 South Exeter St., $33,898. Noted Mar. 26.

Mass., Canton—Town, F. T. Hill, sewer comr., sewerage system, Chapman St., to Reynolds Bros., Inc., 179 Summer St., Boston. Est. $25,000-$50,000.

Mass., Milford—Town, Bd. Selectmen, sewerage work, concrete sidewalks, Leonard and Beach Sts., etc., day labor. $25,000.

N. Y., Long Island City—G. U. Harvey, pres. Queens Boro, Queens Subway Bldg., sewers in Ely Ave., to Doric Holding Co., 734 Vernon Ave., $2,070; in Himrod St., to E. Meluccio, 1209 61st St., Brooklyn, $4,115; 169th St. and 119th Rd., to R. Tomsetti, 1074 60th St., $2,072 and $1,360 respectively; 95th Ave., to Flushing Contg. Eng. Co., 66 Wyoming Ave., Forest Hills, $57,168; 99th and 109th Aves., to Franzese & Catapano, $8,308 and $3,372 respectively; 214th Pl., to Marmoth Constr. Co., 94-14 108th Ave., Jamaica, $896; Bailsey Blvd., to Logran Contg. Co., 2301 Beverly Rd., Brooklyn, $11,555; Springfield Blvd., to Frederico & Franz, 289 Logan St., Brooklyn, $5,042. Grand total $95,-969. Noted Mar. 26.

O., Akron—Summit Co., sanitary sewers in Fairlawn Heights area, to F. George, 1657 Mahoning Ave., Youngstown, and Akron, $30,-548. Est. $35,000.

Pa., Phila.—Dpt. P. Wks., Bureau Eng. & Surveys, City Hall Annex, A. Murdock, dir., to A. Frunzi, 513 High St., branch sewers in Amber St. from Letterly to Sergeant Sts. $11,-620, Norris St. from 16th to 17th Sts. $8,620; to E. Di Sandro, 609 West Rising Sun Ave., Annsbury St. from G to H Sts. and Penhurst St. from Annsbury to Wyoming Sts. $14,900; to J. J. McHugh, 1617 Race St., Bridge St. from point northwest of Garden St. to point southwest of Garden St. $14,554; to A. Di Sandro & Son, 6400 North 5th St., Erdrick St. from Rhawn St. to summit north of Welsh St. $12,231, State Rd. from Unruh to Longshore Sts. $15,708, sewage disposal project, intercepting sewer in Bristol St. from Belgrade St. to Lower Frankfort Creek $3,760—to Yebman & Garafola, 3701 North Broad St., branch sewers in Franklin St. from Poplar to Columbia Sts. $79,259, main sewer in Frankfort Branch Pennsylvania & Reading Ry. right-of-way from Bingham St. to Whitaker Ave. $35,674; to Mazola & Marano, 739 South 7th St., branch sewer in 7th St. from Parrish to Girard Sts. $27,855, 20th St. from Christian to Washington Sts. $18,433; to G. Delise & A. De Angelo, 4842 North Leighgow St., State Rd. from Burton to Cottman Sts. $998; to Pandon Constr. Co., 1108 North 41st St., Stenton Ave. from Broad St. to Old York Rd. $4,402; to DeSipio & Vallone, 28th and Wolf Sts., Walnut St. from 38th to 39th Sts. $5,993; Woodstock St. from Diamond to Susquehanna Sts. $8,324; to D. Sabatini & Son, 2008 McKean St., Wissinoming St. from Princeton to Cottman Sts. $14,112; to McClintic-Marshall Corp., Bethlehem St., structural steel for University Ave. Bridge, $102,705; to M. Masse, 3936 North Reese St., grading B St. from Erie to Venango Sts. $4,221. Grand total $383,369. Noted Mar. 26.

WASTE DISPOSAL

BIDS ASKED

Pa., Altoona—Apr. 29, by City, B. Keatley, dir., Dpt. Streets & Pub. Impvts., City Bldg., 2 story, brick, concrete incinerator, 2,025 sq.ft. floor space on each floor, 3.6 tons rough garbage per hr., incl. furnaces, preheater, chimney. $50,000. H. J. Baum, City Bldg., engr.

BRIDGES

PROPOSED WORK

California—State Hy. Comn., Sacramento, widening Mission Blvd. Bridge from 21 to 42 ft. over Santa Ana River, at foot Mt. Rubidoux, constructing new concrete approaches at each end. Riverside Co. To exceed $100,000. C. H. Purcell, hy. engr.

Calif., Modesto—Stanislaus Co., widening from 26 to 40 ft. Dry Creek Bridge, 170 ft. long. G. Macomber, Modesto, co. surv.

Calif., Stockton—San Joaquin Co. plans Garwood Ferry and Beaver Slough Bridges. $75,-000. J. Manthey, Stockton, co. surv.

N. J., Paterson—Bd. Freeholders Passaic Co., Court House, 260 ft. steel, concrete bridge, 40 ft., at Spruce St. $275,000. G. Ferguson, Court House, co. engr. Noted Nov. 27.

Ont., Toronto—City, R. C. Harris, engr., City Hall, 300 ft. concrete, steel bridge, concrete abutments piers and flooring over Canadian Natl. R.R., on Patricia Dr. $128,140.

BIDS ASKED

Arkansas—Apr. 29, by State Hy. Dpt., Little Rock, three 70 ft., six 40 ft. and two 35 ft. span rein.-con. deck girder bridges, concrete piers, abutments, Job 953, Route 65, Sect. 5, Federal Aid Project 279-D, Searcy Co., $46,840; eight 36 ft., four 20 ft., three 30 ft. deck girder bridges, Job 10183, Route 67, Sects. 19 and 20, Federal Aid 6 Reopened, Lawrence and Randolph Counties, $38,760. C. S. Christian, hy. engr.

Calif., Metz—See "Contracts Awarded."

Calif., Placerville—May 5, by A. J. Koletzke, clk. El Dorado Co., rein.-con. girder bridge for south approach Coloma Bridge on South Fork American River, incl. 125 cu.yd. rein.-con.

Calif., Visalia—May 4, by G. Stewart, clk. Tulare Co., bridge over St. Johns River, at Dinuba Blvd., incl. 577 cu.yd. A and 58 cu.yd. F concrete, 458 cu.yd. A concrete in paving, 1,632 lin.ft. concrete piling (driving only), 4,500 cu.yd. earth fill. County furnishes materials. T. W. Switzer, Visalia, co. surv.

Georgia—Apr. 30, by J. W. Barnett, engr., East Point, bridge on Washington-Thomson Rd., Federal Aid Project 296-C, Wilkes and McDuffie Counties—5 bridges on Waycross-Jesup Rd., Flood Relief Project 4, Wayne and Pierce Counties.

Kansas—Apr. 28, by State Hy. Dpt., Court House, Fredonia, ten 30 ft., two 80 ft., one 130 ft. span deck girder bridge, U. S. Hy. 75, Wilson Co. Former contract rescinded. W. V. Buck, Topeka, hy. engr.

Michigan — Apr. 30, by C. A. Miller, div. bridge engr., 504 Eddy Bldg., Saginaw, Bd. 1 of 76-8-1, Contr. 1, widening existing superstructure from 17 ft. r.w. to 22 ft. roadway, Shiawassee Co., for State Hy. Comn., Lansing.

Mississippi and Alabama—Apr. 28, by State Hy. Comn. of Mississippi, Jackson and State Hy. Comn. of Alabama, Montgomery, at Alabama State Hy. Dpt., Montgomery, 1,400 ft. bridge, incl. 1,000 cu.yd. Class A concrete, 217,000 lb. reinforcing and 443,000 lb. structural steel, 29,300 ft. treated timber, 9,300 lin.ft. treated and 900 ft. untreated piling driven, 1,000 lin.ft. untreated timber piling furnished, 2,700 lin.ft. Type B handrail, 10 test piles, 375 cu.yd. excav. over Escatawpa River from Mobile Co., Ala. to George Co., Miss., $69,848.

Missouri—May 2, by State Hy. Dpt., Jefferson City, concrete, steel and timber bridges in various counties. T. H. Cutler, ch. engr.

N. J., Shrewsbury—May 6, by Bd. Freeholders Monmouth Co., Court House, Freehold, concrete, steel, bridge over Central R.R. on Shrewsbury Ave. G. K. Allen, Jr., 60 Broad St., Red Band, co. engr.; adv. E. N.-R. Apr. 23.

New York—See "Streets and Roads."

N. Y., Shelter Island and Brookhaven—Suffolk Co. (Riverhead), bids about May 15 on substructures and latter part of June on superstructures bridges connecting Shelter Island with mainland, on north and south sides of Island; bridge, approaches from mainland to Ocean Beach at Smith's Point, Brookhaven, $3,350,-000. Robinson & Steinman, 117 Liberty St., New York, engrs. Noted Apr. 9.

Okla., Guthrie—Apr. 28, by State Hy. Dpt., Oklahoma City, 6 span 899 ft. steel truss bridge on concrete piers over Cimarron River, Logan Co., near here, $110,000. A. R. Losh, hy. engr.

Pennsylvania—See "Streets and Roads."

Tex., Houston—Apr. 27, by Harris Co., c/o H. L. Washburn, aud., rein.-con. bridge over Cedar Bayou, on East Ave. extension, Units 1 and 2—rein.-con. bridge over Simms Bayou, on City Farm Rd.—rein.-con. treated timber trestle over Cedar Bayou on East Texas Ave. C. R. Haile, Houston, co. engr. Noted Mar. 12.

Va., Richmond — May 4, at office R. K. Compton, dir. P. Wks., 66 ft. rein.-con. bridge on concrete piles with cantilever sidewalks; adv. E. N.-R. Apr. 23.

CONTRACTS AWARDED

California — C. H. Purcell, engr. State Hy. Comn., Sacramento, four 35 ft. span rein.-con. bridge on concrete bents, abutments, 24 ft. roadway, incl. grading, concrete paving approaches over Carnadero Creek, 2 mi. south of Gilroy, Santa Clara Co., to Oberg Bros., 3470 Hollenbeck Ave., Los Angeles, $50,158. Noted Mar. 26.

Calif., Metz—Bd. Supervs, Monterey Co. (Salinas), steel, timber bridge over Chalone Creek on Soledad King Rd., by day labor. Former bids rejected.

Illinois — State Dpt. P. Wks. & Buildings, Div. Hys., Springfield, bridges in Whiteside Co., to Federal Bridge Co., Bankers Trust Bldg., Des Moines, Ia., $25,407—Cook Co., to Arcole Constr. Co., Niles Center $76,436—Route 80, Sect. 107-B, Whiteside Co., to Clinton Eng. Co., Clinton, Ia., $10,512—Route 80, Sect. 107-C, Whiteside Co., to Vincennes Bridge Co., Vincennes, Ind., $7,661 — DeWitt Co., to Watt Constr. Co., Winchester, $27,765. Grand total $147,781. Noted Jan. 22 and Feb. 19.

Ill., Chicago—Sanitary Dist. of Chicago, 910 South Michigan Ave., J. J. Sullivan, clk., completing substructure South Harlem Avenue Bridge over Drainage Canal, to Greene & Sons Co., 6 North Michigan Ave., $79,439. Former contractor failed to complete the project. Noted Jan. 15.

Kansas—State Hy. Comn., Court House, Winfield, 4 bridges, Barton Co., to E. W. King, Hesston, $31,189 — Bridge 1, Cowley Co., to Kansas Constr. Co., Topeka, $6,796—Bridge 2, Cowley Co., to S. B. Murphy, Centralia, $10,798—Bridge 3, Cowley Co., to J. W. Gaston, Larned, $8,193—1 bridge, Butler Co., to J. R. Stewart, El Dorado, $1,959—1 bridge, Sedgwick Co., to Tomlinson Bridge & Supply Co., Wichita, $9,831. Grand total $68,766. Noted Mar. 19 under "Streets and Roads."

Missouri—State Hy. Bd., Jefferson City, to Pittsburgh Des Moines Steel Co., Tuttle and Southwest 10th Sts., Des Moines, Ia., bridges over Beaver Dam Creek, Audrain Co., $11,625—to C. H. Atkinson Paving Co., Watertown, S. D., over Porter Branch, Holt Co., $1,154—to Graham Bros., 6519 East 37th St., Kansas City, over Nicholas Creek, Holt Co., $4,594—to J. A. Tobin Constr. Co., 266 West 39th St., Kansas City, over branch, $963; over Spring Branch, $2,577; over Spring Branch, $2,488, all foregoing Christian Co.—to P. McGlone, Harrisonville, over North River, $37,068; over Fabius River, $22,758; over branch, $1,343; over Lazy Branch, $4,254, all foregoing Marion Co.—to Samples & Elsea, Kirksville, over Drainage Ditch, Clay Co., $14,673; over Yellow Creek, Sullivan Co., $3,634—to Dungey & Cochran, Marion, Ill., over Cemetery Underpass, St. Louis Co., $12,599; over Route 77, St. Louis Co., $36,808; over Gravois Creek, St. Louis Co., $8,214—to J. Spitcaufsky, Kansas City, over Little Pommer Terre, $30,128; over Blue Branch, $3,391, both Benton Co.—to Richmond Constr. Co., Advance, over drain, $857; over old channel of Castor River, $6,631, both Stoddard Co. Grand total $205,759. Noted Mar. 12.

Missouri—State Hy. Bd., Jefferson City, to McMahan-Waller Constr. Co., Rich Hill, bridges over branch, Oswego Co., $1,682—to E. W. Deering, St. Louis, over St. Francis River, Madison Co., $18,373—to Davis Constr. Co., Boonville, over Maries River, Osage Co., $40,850—to G. E. Stoner, Charleston, over Big Piney River, Texas Co., $34,601—to A. C. Longfield, LaPlata, over Black Creek, Shelby Co., $17,790—to D. B. Talbott, Murphysboro, Ill., over West Drainage Ditch 1 Overflow, $3,067; over West Drainage Ditch 1, $2,501; over West Drainage Ditch 1 Overflow, $4,901, all foregoing in Dunklin Co.—to Chernus Constr. Co., 322 Plym Bldg., Minneapolis, Minn., over Drainage Ditch 1, $2,863; over Drainage Ditch 2, $4,626; over Drainage Ditch A, $2,885; over East Slough, $1,344, all foregoing New Madrid Co.—to R. E. Martin, Nashville, Tenn., over Brush Creek, $17,802; over Prairie Creek, $5,294; over branch Prairie Valley Creek, $2,318, all foregoing in Crawford Co.; over creek, $3,170; over Red Oak Creek, $4,496; over creek, $1,375; all foregoing in Gasconade Co.—to M. Wunderlich, 734 Snell Ave., St. Paul, Minn., over Coon Creek, $7,475; over Old Sugar Creek, $6,521; over Sugar Creek Drainage Ditch, $3,629, all foregoing Grundy Co.—to Henderson Constr. Co., Richmond, over Chicago, Burlington & Quincy R.R., $23,223; over Third Fork, Platte River, $10,473, both DeKalb Co.—to F. T. O'Dell, Hannibal, over Bear Creek, $19,-338; over Wabash and Chicago, Burlington & Quincy R.R., $15,774, both Ralls Co.—to R. B. Potashnick, Cape Girardeau, over Drainage Ditch, $4,149; over Drainage Ditch 7, $3,590, both Ripley Co.—to R. H. Sharp, Reed Springs, over Lousy Branch, Dade Co., $2,611. Grand total $266,730. Noted Apr. 2.

Mo., St. Louis—Bd. P. Serv., City Hall, rein.-con. founds., abutments, piers, retaining walls for 7,000 ft. approach to Municipal Bridge across Mississippi River, to Moore Bros. Constr. Co., 2000 St. Clair Ave., East St. Louis, Ill., $320,337; fabricating, furnishing 7,000 tons steel, to Mississippi Valley Structural Steel Co., 3117 Big Bend Blvd., at $61.95 per ton, total $443,650. Noted Mar. 19.

New Jersey — State Hy. Comn., Trenton, bridge to carry Route S-14 over Route 43, at Berlin, Camden Co., to Young Bros., Harrison Bldg., Phila., Pa., $22,329. Noted Apr. 2.

Tex., Dallas—Dallas Co., c/o C. Gross, repairing, Houston St. Viaduct, connecting Oak Cliff and here, incl. new lighting system, gunite walk, new sidewalks, bannisters, to J. L. and E. A. Vilbig, 2517 Eakin St., $60,363. Noted Mar. 26.

Virginia—See "Streets and Roads."

B. C., Prince George—Provincial Govt., Victoria, timber hy. bridge over Nechako River, to Stuart Cameron & Co., 543 Granville St., Vancouver, $46,284.

STREETS AND ROADS

BIDS ASKED

Arkansas — Apr. 29, by State Hy. Comn., Little Rock, **(F.A.P. means Federal Aid Project)**, grading, drainage structures 9 mi. Job 490, between Rogers and Bestwater, Route 62-2, F.A.P. 108-C Reopened, Benton Co., $60,000—5.85 mi. Job 950, west of Marshall, Route 65-5, F.A.P. 279-C, Searcy Co., $110,000—concrete surfacing 6 mi. Job 694 between Donaldson

Const. News page 172

New concrete sea wall, Palm Beach, Fla. Fugate & Brockway, engineers; Wells & Forbes, contractors, both of West Palm Beach. Illustration to left shows completed wall before tempest; below, after tempest.

Three Day Quality Concrete Withstands Tempest

Three days after completion of a new quality concrete sea wall at Palm Beach, Florida, a severe "nor'easter" hit Palm Beach. Although the wall was subjected to terrific wave impact, it withstood the storm perfectly. This is only one of many excellent examples showing the strength and durability of quality concrete.

The wall is of the step-and-rollway type. Step forms were stripped in 12 hours; all others in 24 hours.

The methods used to obtain quality concrete do not entail extra materials or expense. They produce concrete which is stronger, more durable, and more watertight than that obtained by methods of mixing and placing as ordinarily used. Detailed description of quality concrete, the methods used to secure it and the average results that may be expected with Universal or Atlas portland cement, will be sent on request.

97-A

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CHICAGO · NEW YORK · PITTSBURGH · MINNEAPOLIS · ST. LOUIS

Streets and Roads (Continued)

and Friendship Route 51-3, F.A.P. 271-D. Hot Springs Co. $100,000—4.5 mi. Job 6123, Route 70-17, F.A.P. 185-D, Prairie Co., $80,000. C. S. Christian, hy. engr.

Calif., Los Angeles—Apr. 29, by Bd. P. Wks., City Hall, grading, curbing, sidewalks, 6 in. concrete paving 238,800 sq.ft. 112th St. and Bellhaven St. Impvt. Dis.

Calif., Nevada City—R. N. McCormack, clk. Nevada Co., will take new bids clearing, grubbing, grading, drainage structures, surfacing road from Grass Valley to Colfax. Former bids returned on opening. J. F. O'Connor, Nevada City, engr. Noted Mar. 19.

Calif., San Diego—May 4, by City Council, grading, curbing, sidewalks, 6 in. concrete surfacing 13,885 sq.yd., 6 in. asphaltic concrete surfacing 29,455 sq.yd. Addison St., et al. H. W. Jorgensen, City Hall, engr.

Calif., San Rafael—Apr. 27, by R. Graham, clk, Marin Co., improving San Geronimo-Nicasio Rd., incl. 63,000 cu.yd. excav. without classification, 85,000 sta. overhaul, 12- to 60-in. corrugated metal pipe. R. Messner, San Rafael, co. surv.

Calif., Santa Ana—Apr. 28, by Bd. Supervs. Orange Co., grading, corrugated metal pipe culverts, gravel surfacing 218,700 sq.ft. Santiago Canyon Rd.

Calif., Ventura — May 5, by Bd. Supervs. Ventura Co., improving Telegraph Rd., incl. 10,500 cu.yd. earthwork embankment, 2,130 tons asphaltic concrete, concrete pavement, corrugated iron pipe.

Ind., South Bend—May 4, by Bd. Comrs., St. Joseph Co., concrete surfacing Otto Baker Rd. $43,000—Spring Street Rd. $10,700—Homer Short Rd. $77,800. F. P. Crowe, South Bend, aud.

Ind., Valparaiso — Apr. 30, by Bd. Comrs. Porter Co., concrete surfacing 2.994 mi. F. C. Linderman Rd., Jackson and Liberty Twps. $34,200. C. A. Blachly, Valparaiso, aud.

Ind., Valparaiso — Apr. 30, by Bd. Comrs. Porter Co., concrete surfacing 5.31 mi. B. T. Kemil Rd., Westchester and Pine Twps. $122,227. C. A. Blachly, Valparaiso, aud.

Ia., Cherokee — Apr. 28, at office Auditor Cherokee Co., clearing, grubbing, grading, incidental work 15 mi. roads.

Kansas—Apr. 28, by State Hy. Comn., Court House, Independence **(P. means Project and K.P. Kansas Project)**, bituminous blotter treating 0.738 mi. P.160-32, K.P.1160—0.624 mi. P. 160-33, K.P.1161—5.17 mi. P.160-34, K.P.1162, all Elk Co.—bituminous drag treatment resurfacing 15.9 mi. P.166-13, K.P.7306, Labette Co. —3 mi. P.16-6, K.P.7303—1.5 mi. P.160-34, K.P.7307—5 mi. P.160-37, K.P.7308—3.25 mi. P.75-2, K.P.7309—20 mi. P.75-3, K.P.7310—1.5 mi. P.75-5, K.P.7311, all Montgomery Co.—regravel surfacing 10 mi. P.160-43, K.P.7300, Crawford Co.—11.25 mi. P.75-16, K.P.7301, Coffey Co.—11 mi. P.160-35, K.P.7304, Montgomery Co.—6 mi. P.54-35, K.P.7305, Woodson Co. W. V. Buck, Topeka, hy. engr.

Kansas—Apr. 30, by State Hy. Comn., Court House, Concordia **(P. means Project and K.P. Kansas Project)**, traffic bound macadam surfacing 8 mi. P.18-8, K.P.1163, Lincoln Co.—sand gravel resurfacing 11.5 mi. P.81-25, F.A.P. 7356—9.5 mi. P.36-20, F.A.P.7357, both Republic Co.—14.4 mi. P.81-22, K.P.7358—8.3 mi. P.81-23, K.P.7359—15.7 mi. P.9-15, K.P. 7360—bituminous blotter treating 4 mi. P.81-20, K.P.7356—15 mi. P.40N-20, K.P.7366, all Cloud Co.—sand gravel surfacing 5.25 mi. P. 36-17, K.P.7368, Jewell Co.—5.6 mi. P.9-16, K.P.7361—8.7 mi. P.9-17, K.P.7362, both Washington Co.—bituminous blotter treating 3 mi. P.81-13, K.P.7363—14.4 mi. P.50N-17, K.P. 7364, both McPherson Co.—12.6 mi. P.81-19, K.P.7367, Ottawa Co. W. V. Buck, Topeka, engr.

Maryland—Apr. 28, by State Roads Comn., Baltimore, G. C. Uhl, chn., grading 2.74 mi. Constr. BC-101-72, Baltimore City—concrete paving 1 mi. Contr. B-183-44, Baltimore Co.—1.2 mi. Contr. H-119-42, Harford Co.—gravel paving 2 mi. Contr. Ch-102-82, Charles Co.—penetration macadam paving 1 mi. Contr. Ho-93-52, Howard Co.; adv. E. N.-R. Apr. 23.

Massachusetts — Apr. 28, by Dpt. P. Wks., Boston, bituminous macadam paving 22,120 ft. and reconstructing 1,031 ft. hys. in Bellingham, Milford, Hopedale and Mendon; bituminous macadam paving 24,096 ft. and reconstructing 17,659 ft. hys. in Duxbury, Kingston and Pembroke. A. W. Dean, Dpt. P. Wks., Boston, engr.

Mass., Attleboro—See "Contracts Awarded."

Mass., Boston—Apr. 24, by Dpt. P. Wks., J. A. Rourke, comr., sheet asphalt or bituminous paving Ward 14, Apr. 27, paving Ward 10. $25,000.

Mass., Boston—Apr. 24 (extended date), by Park Dpt., 33 Beacon St., constructing Castle Island Blvd., South Boston. To exceed $25,000.

Mass., Boston—Apr. 27, by Dpt. P. Wks., J. A. Rourke, comr., sheet asphalt or bitulithic paving streets in Ward 15. $25,000.

Michigan—Apr. 28, at office E. R. Benkert, resident engr., Port Huron, grading, drainage structures, shaping 10.256 mi. F044-26-Contr. 1, Lapeer Co., for State Hy. Comn., Lansing.

Michigan—Apr. 28, at office E. R. Benkert, resident engr., Port Huron, grading, shaping, drainage structures, 2 course gravel surfacing 9.445 mi. MO74-33C-1 and MO79-27C-1, Sanilac and Tuscola Counties, 18 ft., for State Hy. Comn., Lansing.

Michigan — Apr 29, office H. C. Fleming, resident engr., Grand Rapids, grading, shaping, drainage structures, surfacing 3 mi., shaping, 20 ft. concrete surfacing 6.264 mi. F034-10-Contr. 4, Ionia Co., for State Hy. Comn., Lansing.

Missouri—May 2, by State Hy. Dpt., Jefferson City, grading, surfacing with concrete, gravel and chat, roads in various counties. T. H. Cutler, ch. engr.

New Hampshire—Apr. 30, by State Hy. Dpt., Concord, grading, 3 in. on 5 in. gravel surfacing 1.98 mi. Sunapee Lake Rd., Grafton Co., 28 ft., $57,000—3 in. bituminous macadam on 8 in. stone surfacing 1.832 mi. Central Rd., $87,000—6 in. one course rein.-con. on 8 in. gravel paving 2.47 mi. Mascoma Rd., $121,000, both Merrimack Co., 20 ft.

N. J., Freehold—May 6, by Bd. Freeholders Monmouth Co., Court House, Type C concrete on existing found., repaving 9,602 sq.yd. Shrewsbury Ave. Rd. 72, Sect. 2, Shrewsbury Twp. G. K. Allen, Jr., 60 Broad St., Red Bank, co., engr.; adv. E. N.-R. Apr. 23.

N. J., Ringwood—Apr. 24, by Bd. Council, Ringwood Manor School, grading, bituminous penetration macadam paving Ringwood Ave. from Spook Brook to Erskine-Sloatsburg Rd. $25,000. E. N. Millen & Son, 491 Ramapo Ave., Pompton Lakes, engrs.

New York—May 12, by A. W. Brandt, comr. Hys., Albany, reconstruction hys., bridges in Albany, Chenango, Erie, Fulton, Jefferson, Lewis, Monroe, Schenectady and Suffolk Counties; adv. E. N.-R. Apr. 23.

N. Y., Long Island City—Apr. 29, by A. Goldman, comr. Plant & Structures, Municipal Bldg., New York, grading, paving area under Queens Viaduct connection to Queensboro Bridge, South Jane St. to Jackson Ave., Queens Boro.

N. Y., New York—Apr. 27, by S. Levy, pres. Manhattan Boro, Municipal Bldg., grading, curbing, flagging, sidewalks, sheet asphalt on concrete paving except strip 10 in. wide parallel and adjacent to railroad tracks, concrete blocks on concrete paving Forsyth and 227th Sts.—grading, curbing, sidewalks, sheet asphalt on concrete paving Bway., 228th and Chestnut Sts. —grading, granite block on concrete paving Gansevoort St. — sidewalk, curbing when and where directed during 1931.

N. Y., Oswego—Apr. 28, by Oswego Co. Hy. Dpt., M. D. Ewell, supt., County Clerk's Bldg., furnishing, delivering, heating and applying Bituminous Material "A" and "T" for constructing and repairing improved roads; adv. E. N.-R. Apr. 23.

Okla., Nichols Hills (Oklahoma City, P. O.) Apr. 27, by T. A. Montague, city clk., grading, 7 in. concrete paving 10,800 sq.yd. Dist. 13, part of Kings Court, $47,000—11,950 sq.yd. Dist. 11, Avondale Dr., $50,000—6,690 sq.yd. Dist. 10, The Strand, $25,000, Benham Eng. Co., Perrine Bldg., Oklahoma City, engrs.

Okla., Tulsa—May 1, by E. Logan, city aud., widening 9 blocks 4th St. from Greenwood to Owasso Sts., 20 ft. $33,226. H. A. Parker, City Hall, engr.

Oregon—Apr. 30, by State Hy. Comn., Salem, grading 13 mi. Wallula Cut-off, Umatilla Co., 22 ft., $200,000 — Roosevelt Hy., Lane Co., $100,000—grading, bridging Umqua Hy., Lane Co., $85,000—grading, surfacing Roosevelt Hy., Tillamook Co., $40,000—Columbia River Hy., Wasco Co., $92,000—Old Oregon Trail, Wasco Co., $75,000 — Dalles-California Hy., Klamath Co., $50,000. R. Klein, state hy. engr.

Pennsylvania—Apr. 30 ,by State Hy. Dpt., Harrisburg, grading, bituminous surface treated macadam or bituminous surface treated macadam on broken stone surfacing 33,569 ft. Route 640, Sect. 2, South Beaver Twp., Beaver Co., incl. 69 ft. rein.-con. bridges—27,692 ft. Route 436, Sect. 1, Bell and Gaskill Twps., Jefferson Co.—25,493 ft. Route 750, Sect. 1, Cranberry and President Twps., Venango Co., incl. 57 ft. rein.-con. bridges—rein.-con. surfacing 19,496 ft. Route 131, Sect. 2, Upper and Lower Oxford Twps., Chester Co. — grading, bituminous surface treated macadam on native stone surfacing 47,667 ft. Route 648, Sect. 2, Jermyn and Mayfield Boros, Carbondale, Scott and Greenfield Twps., Lackawanna Co., incl. 145 ft. rein.-con. bridges—16,116 ft. Route 173, Dyberry, Oregon and Lebanon Twps., Wayne Co., incl. grading 75 ft. approaches, also 70 ft. rein.-con. bridges—grading, concrete guttering, bituminous surface treated macadam surfacing 28,172 ft. Route 714, Lower Windsor and Windsor Twps., York Co., incl. 94 ft. rein.-con. bridges. S. S. Lewis, secy.

Pennsylvania — May 1, by State Hy. Dpt., Harrisburg, grading, drainage structures, bituminous surface treated macadam surfacing 50,807 ft. Route 49, Sect. 1, Harrison and Juniata Twps., Manns Choice Boro, Bedford Co., incl. 48 ft. rein.-con. bridges—27,172 ft. Route 715, North Codorus, Codorus and Shrewsbury Twps., York Co., incl. 149 ft. rein.-con. bridges—grading, drainage structures, bituminous treated macadam or bituminous treated macadam on modified broken stone surfacing 25,586 ft. Route 277, Sect. 2, Shippen Twps., Cameron Co. —bituminous surface treated macadam surfacing 15,659 ft., bituminous treated macadam on native stone surfacing 13,841 ft. Route 107, Sect. 5 Worth and Rush Twps., Port Matilda Boro, Centre Co.—11,596 ft. Route 217, Cherry Twp., Sullivan Co.—grading, drainage structures, rein.-con. surfacing 4,650 ft. grading 50 ft. approaches, Route A-6574 and 6575, Northampton Co.—grading, drainage structures, bituminous surface treated macadam on native stone surfacing 5,242 ft., bituminous surface treated macadam on run of bank gravel surfacing 33,642 ft., grading 148 ft. approaches, Route 106, Sect. 1, Delmar, Duncan and Morris Twps., Tioga Co. S. S. Lewis, secy.

Pa., Westmont (mail Johnstown)—May 4, by Boro, H. P. Shomo, secy., grading, curbing, guttering, sewers, 6 in. rein.-con. paving 6,700 sq.yd. Park View Dr. $40,000. O. P. Thomas, 145 Franklin St., Johnstown, engr.

Tex., Houston—May 4, by Harris Co., c/o H. L. Washburn, aud., grading, curbing, guttering, 2 in. asphalt on 6 in. concrete widening 79,342 sq.yd. La Porte Rd. C. R. Haile, Houston, co. engr.

Utah—Apr. 27, by State Hy. Comn., Salt Lake City, grading, crushed graveling 7,500 cu.yd. Lincoln Hy., S.A.P. 310, Summit Co. H. S. Kerr, state hy. engr.

Washington—May 5, by S. J. Humes, dir. Hys., Olympia, crushed stone paving 94,000 cu.yd. State Rd. 3, Teanaway to Ellensburg, Emergency F.A.P. 165-B, 165-E and 165-F, Kittitas Co.—24,100 cu.yd. State Rd. 5 from Divide to West Fork, F.A.P. 164-C, Lewis Co.—concrete paving 2.2 mi. State Rd. 12, Raymond East Paving, F.A.P. 131-E, Pacific Co.

Wash., Seattle—Bd. P. Wks., bids about Apr. 30, widening Wall St. and constructing Armory Way. R. H. Thomson, city engr.

Wash., Olympia — Apr. 27, by Comrs. Thurston Co., concrete paving 2.5 mi. Bucoda, Yelm and Rainer Hys., $51,000. N. R. McKay, Olympia, co. engr.

Wash., Seattle—Bd. P. Wks., bids about Apr. 30, concrete sidewalks on West Charleston St. $26,036. R. G. Thomsen, city engr.

Wash., Yakima—May 4, by Comrs. Yakima Co., grading, graveling, 6 mi. Sheller, Griner, Factory, Reeves and Washout Rds. O. E. Brashears, Yakima, co. engr.

Wisconsin—Apr. 28, by State Hy. Comn. and Hy. Coms. Green, Jefferson and Sauk Counties, Capitol Annex, Madison, grading, concrete paving 11,873 sq.yd. Monroe-Argyle Rd., S.T.H. 14, S.A.P. 1351, Green Co.—gravel or crushed stone surfacing 5,100 cu.yd. Fort Atkinson-Dane Co. Line Rd., S.T.H. 106, S.A.P. 1358, Jefferson Co. —6,000 cu.yd. Monticello-Rock Co. Line Rd., S.T.H. 39 and 59, State Gang Maintenance Projects 6 and 9—1,500 cu.yd. Brodhead-Rock Co. Line Rd.—crushed graveling 1,000 cu.yd. Brooklyn-Westerly Rd., State Gang Maintenance, Project 10, all foregoing Green Co.—7,000 cu.yd. Merrimac-Prairie Du Sac Rd. 9, S.T.H. 81 — 1,200 cu.yd. Baraboo-County Trunk W Rd., S.T.H. 13—3,000 cu.yd. Reedsburg-Mirror Lake Rd.—2,000 cu.yd. Lavalle-Ironton Rd., S.T.H. 58—crushed stone surfacing 1,800 cu.yd. S.T.H. 60, Spring Green-Sauk City Rd., all Sauk Co.

Wisconsin—Apr. 28, by State Hy. Comn. and Hy. Com. Sheboygan Co., grading, concrete surfacing 82,498 sq.yd. Option 1, and 146,579 sq.yd. Option 2, Sheboygan Falls-Waldo-South Co. Line Rd., Sheboygan Co.

Wisconsin—Apr. 30, by State Hy. Comn. and Hy. Coms. Waupaca and Marquette Counties, Citizens Bank Bldg., Wisconsin Rapids, grading, bridging, concrete paving 42,236 sq.yd. Waupaca-Manawa Rd., S.T.H. 22, S.A.P. 4620, Waupaca Co.—grading 4.76 mi. Packwaukee-Westfield Rd., U. S. Hy. 51, F.A.P. 423-G, Marquette Co

Wisconsin—May 1, by State Hy. Comn. and Hy. Coms. Vernon and Buffalo Counties, Batavian Natl. Bank Bldg., La Crosse, grading, concrete paving 14,543 sq.yd. LaCrosse-Westby Rd., U. S. Hy. 61, F.A.P. 412-B, Vernon Co.—grading, drainage structures. Option A 5.654 mi. crushed limestone surfacing 13,000 cu.yd. Option B Nelson-Alma Rd., S.T.H. 35, F.A.P. 468-A, Buffalo Co.

CONTRACTS AWARDED

California — State Hy. Comn., Sacramento, grading 14.2 mi. road in Mono Co., 24 ft., to Robinson Roberts Co., 112 West 9th St., $129,631—5 mi. Los Angeles Co., 26 and 36 ft., to T. M. Morgan Paving Co., 609 South Grand Ave., $399,220—concrete paving 3 mi. San Mateo Co., 40 ft., to Basich Bros. Constr. Co., Torrance, $212,993—grading, concrete surfacing 1.1 mi. bridge approaches 20 and 36 ft., Sonoma Co., to J. V. Galbraith, Petaluma, $14,400. Grand total $756,244. Noted Mar. 26.

Calif., Laguna Beach—City Council, grading, 5 and 6 in. asphaltic concrete paving 113,477 sq.ft. Ocean Ave., to O. U. Miracle, 1604 Dale St., San Diego, $29,520. Noted Apr. 2.

Calif., Long Beach—Curbing, guttering, sidewalks on Jackson St. between Orange and Cherry Sts., to P. Cristich, California Reserve Bldg., Los Angeles, $32,975. Noted Mar. 19.

Calif., Los Angeles—Bd. P. Wks., City Hall, grading, sidewalks, 8 in. concrete paving 80,000 sq.ft. Vermont Ave., to H. M. Baruch Corp., Lincoln Bldg., $25,572.

Connecticut—J. A. Macdonald, state hy. comr., Hartford, rein.-con. paving 21,820 ft. hy., Winchester and Torrington to M. A. Gammino Constr. Co., 728 Valley St., Providence, R. I., $242,399; concrete bridge, Old Saybrook, to A. I. Savin, 408 Main St., Hartford, $20,429. Noted Feb. 26.

Conn., Hartford—Bd. Contr. & Supply, sheet asphalt paving 86,230 sq.yd. Asylum, Belden, Broad, Hicks, Hudson, Jefferson and Woodlawn Sts., to Edward Balf Co., 14 Haynes St., $226,790. Noted Apr. 9.

Florida—State Road Dpt., Tallahassee, B. M. Duncan, state hy. engr., clearing, grubbing, grading, drainage structures, concrete paving 6.28 mi. Broward Co., to Morgan Hill Paving Co., Miami, $261,490—8.7 mi. Volusia Co., to

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Streets and Roads (Continued)

Rutherford Constr. Co., Lake Wales, $332,589—grading, grubbing, drainage structures, paving 4.38 mi. Dade Co., to A. B. Curry Constr. Co., Miami, $114,682. Grand total $708,761. Noted Mar. 26 and Apr. 2.

Illinois — State Dpt. P. Wks. & Buildings, Div. Hys., Springfield, paving Route 46, Sects. 465-Y and 464-Y-1, Cook Co., to I. D. Lain Co., Park Ridge, $112,864 and $67,745 respectively—road in Knox Co., to Birt Bros., Decatur, $10,566—Schuyler Co., to P. Simons, Quincy, $130,086 — DeKalb Co., to McCarthy Impvt. Co., Kahl Bldg., Davenport, Ia., $137,881 — Morgan Co., to Jaicks Bros., 77 West Washington St., Chicago, $101,903 — Logan Co., to Cameron-Joyce & Co., Keokuk, Ia., $131,742—Cook Co., to Arcole Constr. Co., Niles Center, $74,564—grading Route 85, Sects. 102A and 103A, in Mercer Co., to Swords-McDougal, Knapp & Co., Peoria, $21,426 and $18,376 respectively—Rock Island Co., to Littig Constr. Co., Davenport, Ia., $48,677. Grand total $856,030. Noted Feb. 19 and Jan. 22.

Ill., Chicago—Bd. Local Impvts., City Hall, to Ready Coal & Constr. Co., 133 West Washington St., grading, curbing, guttering, filling in, sewers, 10 in. concrete paving Anthony Ave. $168,086—to Calumet Coal Co., 9022 Commercial Ave., Ewing Ave. $97,451—to Peter O'Brien & Co., 4 North Cicero Ave., North Moody Ave. $29,925—to Home Paving Co., 134 North La Salle St., Wilson Ave. $19,572—to White Paving Co., 1735 Fullerton Ave., grading, curbing, guttering, sewers, asphalt on 8 in. concrete paving North Ashland Ave., $17,643, Laflin St. $144,000; Gunnison St. and North Austin Ave. $183,886—to Barber Paving Co., 7 South Dearborn St., North Austin Ave. $33,098—to W. H. Bransfield Co., 3525 South Leavitt St., Cottage Grove Ave. $108,443—to R. F. Conway Co., 33 North La Salle St., grading, curbing, guttering, sewers, asphalt on 6 in. concrete paving West 58th St. $11,841; West 58th Pl. $12,341—to Commonwealth Impvt. Co., 179 West Washington St., grading, curbing, guttering, sewers, reshaping present macadam, asphaltic concrete repaving Indiana Ave. $44,-901. Grand total $871,187.

Ind., Valparaiso — Porter Co., gravel surfacing 3.998 mi. J. F. Benderkop, H. F. Black and C. J. Gut Rds., to W. St. Clair & G. McGillicuddy, Valparaiso. Est. $40,447. Noted Mar. 12.

Ia., Guthrie — Guthrie Co., grading 60,000 cu.yd. local and trunk roads, to J. H. Miller & Son, Des Moines, at $0.14 per cu.yd., 70,000 cu.yd., to J. Shipley, Guthrie, $0.21. Noted Mar. 26.

Ia., Sac City—Bd. Comrs. Sac Co., gravel surfacing 42.5 mi. local roads, to J. H. Hartsell, Early, and C. L. Rutherford, Oskaloosa.

Kansas—State Hy. Comm., Court House, Winfield, **(F.A.P. means Federal Aid Project)**, to Roberts Constr. Co., Bitting Bldg., Wichita, concrete surfacing 3.876 mi. F.A.P. 230-F, $87,-526; 3.485 mi. F.A.P. 230-B, $75,070; 0.134 mi. F.A.P. 230-D, $2,203; 3.647 mi. F.A.P. 230-A, $78,293, all Cowley Co.—to Geiger & Rutherford, Leavenworth, 4.837 mi. F.A.P. 399-E, Harvey Co., $96,968—to E. Graff, Newton, grading, drainage structures 6.902 mi. F.A.P. 356-H, Cowley Co., $75,834—to A. L. Cook, Ottawa, 0.47 mi. F.A.P. 331-G, Barton Co., $48,769 — to E. L. Cavanah, Newton, 8.193 mi. F.A.P. 356-C, Cowley Co., $170,490—to J. R. Stewart, Eldorado, 3.325 mi. F.A.P. 396-A, Butler Co., $17,785; 11.741 mi. F.A.P 396-B, Butler Co., $76,853. Grand total $729,-791. Noted Mar. 19.

Kan., Wichita—City Council, grading, curbing, guttering, rein.-con. paving 30,000 sq.yd. streets, alleys, to Globe Constr. Co., 1041 North Water St., at $1.50 per sq.yd. Est. $55,000.

Maine — State Hy. Dpt., Augusta, concrete paving 0.63 mi. hy., Dover and Foxcroft, and bituminous macadam paving 2.7 mi. Bar Harbor, to Rogers & Mulaney, Bangor, $15,831 and $75,680 respectively—5.51 mi. Caribou, to A. D. Bridges, Hazardville, Conn., $154,628—gravel surfacing 2.05 mi. Perry, to R. Cianchette, Pittsfield, $29,708—7.78 mi. Connor and Cyr, to Cyr & Suci, Lille, $138,486—4.51 mi. Charleston, to R. M. Davis, Oldtown, $87,-656—concrete paving 1 mi. Fort Kent, to Joseph McCabe Co., South Boston, Mass., $46,-000—grading and base 5.7 mi. Woolwich and Wiscassett, to R. J. Gillett, Westfield, Mass., $88,571. Grand total $636,560. Noted Mar. 26.

Maryland — State Roads Comn., Baltimore, G. C. Uhl, chn., concrete paving 1 mi. Contr. Ho-91-54, Howard Co., to Caton Contg. Co., Halethorpe, $27,692. Noted Mar. 19.

Massachusetts—Dpt. P. Wks., State House, Boston, bituminous macadam paving 10,804 ft. hy., constructing concrete steel bridge, Hingham and Hull, to Waterbury Road Constr. Co., 983 Main St., Hartford, Conn., $329,073—rein.-con. paving 28,430 ft. hy., constructing concrete steel bridge, Northboro and Shrewsbury, to Lane Constr. Corp., 134 State St., Meriden, Conn., $446,928. Noted Apr. 2.

Mass., Braintree — Town, Bd. Selectmen, cement curbing, sidewalks, to A. C. Trojano, 21 Shaw St. Est. $25,000. Noted Apr. 2.

Mass., Milford—See "Sewers."

Minnesota — State Hy. Dpt., St. Paul, to Nolan Bros., 18 North 2nd St., Minneapolis, grading, concrete paving 160,700 sq.yd. S.P. 3-42, Divs. B and C, $209,462; 228,533 sq.yd. S.P. 9-23, Divs. A and D, Federal Aid Project 224, and S.P. 9-23, $338,291; 143,357 sq.yd. S.P. 10-32, Federal Aid Project 211, $175,758;

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193,040 sq.yd. S.P. 14-24, Sect. 4, Div. A, Federal Aid Project 406-G, S.P. 14-24, Sect. 4, Div. B, Federal Aid Project 406-B, S.P. 14-24, Sect. 4, Div. C, S.P. 14-24, Sect. 3, Federal Aid Project 355-C, and S.P. 14-24, Sect. 2, Div. A, $243,362—to Foley Bros., 209 Gilfillan Block, St. Paul, grading 444,000 cu.yd. S.P. 4-47, $124,-183—to R. P. England, Mitchell, S. D., 443,000 cu.yd. S.P. 7-29, 7-30 and 7-46, $115,466; 165,-000 cu.yd. S.P. 14-26, Sect. 1, $38,121—to W. M. Petrie, Champlin, 270,000 cu.yd. S.P. 18-25, Sect. B, $66,142—to A. Guthrie & Co., Builders Exch., St. Paul, 675,000 cu.yd. S.P. 46-21, $306,828; 307,000 cu.yd. S.P. 1-45, Sect. 1, $231,748. Grand total $1,849,361. State furnishes cement. Noted Mar. 26.

Missouri — State Hy. Bd., Jefferson City, to Henderson Constr. Co., Richmond, grading 0.322 mi. Andrew Co., $1,112; 3.558 mi. DeKalb Co., $41,863—to McMahan-Waller Constr. Co., Rich Hill, 2.896 mi. Osage Co., $27,541—to B. F. Brooks, Dallas, Tex., crushed stone surfacing 4.01 mi. Howard Co., $24,792; 2.613 mi. same county, $14,093—to E. W. Deering, St. Louis, grading 0.157 mi. Madison Co., $4,780 — to Chernus Constr. Co., 322 Plym Bldg., Minneapolis, Minn., 0.398 mi. New Madrid Co., $3,288; to R. B. Potashnick, Cape Girardeau, 2.905 mi. Ripley Co., $14,621—to A. C. Longfield, La Plata, 1.352 mi. Shelby Co., $16,425—to E. K. Porter, Carrollton, 3.845 mi. Montgomery Co., $14,426—to W. D. Knoll, Lowry City, 3.648 mi. Monroe Co., $4,621; 4.204 mi. Monroe Co., $5,545; 3.177 mi. same county, $4,093—to Kornbmaker Co., Excelsior, 1.228 mi. Worth Co., $728; 4.242 mi. same county, $2,137; 4.738 mi. same county, $2,332; 3.655 mi. same county, $2,488; 3.788 mi. same county, $3,806; 2.547 mi. same county, $1,919—to R. E. Martin, Nashville, Tenn., 3.399 mi. Crawford Co., $25,153; 3.968 mi. same county, $35,483; 3.842 mi. same county, $22,504; 4.884 mi. Gasconade Co., $74,642; 4.964 mi. same county, $39,704 — to G. E. Stoner, Charleston, 3.458 mi. Texas Co., $27,743; 4.184 mi. same county, $22,585—to D. V. Talbott, Murphysboro, Ill., 0.589 mi. Dunklin Co., $2,230; 2.969 mi. same county, $12,711—to R. H. Sharp, Reed Springs, crushed rock surfacing 4.636 mi. Dade Co., $15,189; to M. Wunderlich, 724 Snell Ave., Minneapolis, Minn., 2.291 mi. Stone Co., $11,145; chats surfacing 3.818 mi. Carroll Co., $12,638; graveling 4.973 mi. Douglas Co., $37,421; 4.163 mi. same county, $29,278; grading 4.167 mi. same county, $8,223; 4.18 mi. same county, $9,243—to F. T. O'Dell, Hannibal, grading, concrete paving 0.513 mi. Ralls Co., $32,415—to Davis Constr. Co., Inc., Boonville, 2.677 mi. Osage Co., $76,251; 1.473 mi. same county, $47,731 — to Carlon Constr. Co., Maplewood, 4.848 mi. Harrison Co., $34,201; 2.75 mi. same county, $17,954; 4.962 mi. same county, $34,598 — to Koss Constr. Co., Des Moines, Ia., 3.533 mi. Lawrence Co., $68,055. Grand total $887,207. Rejected bids Apr. 4, graveling Dent Co. Noted Apr. 2.

Missouri—State Hy. Bd., Jefferson City, to Dungey & Cochrane, Marion, Ill., grading, concrete paving 3.413 mi. St. Louis Co., $54,191; 0.473 mi. same county, $19,957; 3.992 mi. same county, $140,404; 3.239 mi. same county, $34,-280—to Perry McGlone, Harrisonville, 4.981 mi. Marion Co., $85,265; 3.86 mi. same county, $95,559—to Hoeffken Bros., Belleville, Ill., 4.539 mi. Johnson Co., $67,964; 4.816 mi. same county, $68,108; 4.512 mi. same county, $67,489—to C. H. Atkinson Paving Co., Watertown, S. D., 3.164 mi. Holt Co., $29,105; 3.255 mi. same county, $25,510; 4.955 mi. same county, $39,323; 3.609 mi. same county, $38,-500; 3.664 mi. same county, $44,272 — to Samples & Elsea, Kirksville, 1.424 mi. Clay Co., $96,537; 1.467 mi. same county, $26,709; graveling 4.952 mi. Sullivan Co., $11,494; 3.344 mi. same county, $10,966—to S. G. Hayes & Co., 910 South Michigan Ave., Chicago, Ill., 2.107 mi. Osage Co., $9,841; 4.211 mi. same county, $13,573—to Garrett Constr. Co., Springfield, 3.451 mi. Dallas Co., $10,367; 3.182 mi. same county, $8,043—to M. Wunderlich, 734 Snell Ave., Minneapolis, Minn., 3.976 mi. Barry Co., $11,442; 4.432 mi. same county, $11,399—to J. A. Tobin Constr. Co., 266 West 39th St., Kansas City, 3.74 mi. Christian Co., $19,835; 3.606 mi. same county, $28,773—to J. Spitcaufsky, Kansas City, 1.238 mi. Benton Co., $23,458; 1.507 mi. same county, $13,110; 0.66 mi. same county, $20,567—to Richmond Constr. Co., Advance, 3.228 mi. Stoddard Co., $13,530—to E. C. Johnson Constr. Co., Carrollton, 3.103 mi. Washington Co., $11,567—to Pittsburgh-Des Moines Steel Co., Tuttle and Southwest 10th Sts., Des Moines, Ia., 0.172 mi. Audrain Co., $3,045—to C. G. Rose, Brookfield, crushed stone surfacing 3.049 mi. Caldwell Co., $12,091; 2.994 mi. same county, $8,594—to Graham Bros. Constr. Co., 6519 East 37th St., Kansas City, 3.366 mi. Holt Co., $15,857; 3.151 mi. Andrew Co., $2,476; 1.866 mi. same county, $1,195; 2.557 mi. Holt Co., $2,014—to R. H. Sharp, Reeds Springs, crushed stone and gravel surfacing 4.411 mi. Stone Co., $18,399. Grand total $1,215,009. Graveling 2.992 mi. Monroe Co., by state forces. Noted Mar. 12.

New Jersey—State Hy. Comn., Trenton, 10 in. concrete paving 2.154 mi. Route S-1-A, Sect. Route 1, Sect. 7, Bergen Co., to Giovannone Constr. Co., Bergenfield, $309,386. Noted Apr. 2.

New Jersey—State Hy. Comn., Trenton, grading, granite block paving Route 3, Sects. 1A and 2A, Secaucus, Mercer Co., to A. R. Geist Constr. Co., Phillipsburg, $304,858. Noted Mar. 26.

N. J., Pompton Lakes—Bd. Freeholders Passaic Co., Court House, Paterson, grading, rein.-con. paving Oakland Valley Rd., to R. S. Sowerbutt, 244 Highland Ave., Paterson, $98,761.

N. Y., New York—H. Bruckner, pres. Bronx Boro, Crotona Park, 3rd and Tremont Ave., granite block repaving East Tremont Ave., to Leonard Paving Co., 233 Bway., $255,348—Hunts Point Rd. and Westchester Ave., to St. George Granite Co., 415 Lexington Ave., $98,-651 and $79,196 respectively—ashpalt paving Morris Park Ave., to Bronx Asphalt Co., Zerega Ave. and Westchester Crk, $43,865—grading West 263rd St., to Caserta Constr. Co., 2442 Barnes Ave., $6,072—Hobart Ave., to A. Nusummecci, 277 East 146th St., $3,657. Grand total $486,780. Noted Apr. 2.

N. Y., New York—S. Levy, pres. Manhattan Boro, Municipal Bldg., sidewalks, curbing, granite block paving William St., to Walthaw Corp., 1860 Bway., $8,719. Noted Mar. 5.

N. Y., Syracuse—Bd. Contr. & Supply, City Hall, to Onondaga Constr. Co., 831 Lancaster Ave., repaving, resurfacing Oswego Blvd., Catawba and Spencer Sts., $12,827—to Rago Bros., Union Bldg., South McBride St., $47,126—to G. Dickson, 309 Basin St., Solar St., $16,-814; South Clinton St., $20,752; North Franklin St., $10,422; Plum St., $14,418; Merriman Ave., $6,849. Grand total $129,208. Noted Apr. 9.

North Dakota—State Hy. Comn., Bismarck, concrete paving 12 mi. Cass Co., to J. L. McCormick, Fargo, $295,670. Noted Apr. 2.

Ohio—O. W. Merrell, dir. hys., Columbus, concrete paving 7.643 mi. Athens and Vinton Counties, to F. H. Beckler Co., Athens, $268,-515—4.8599 mi. Clarke Co., to J. F. Stambaugh, Ada, $101,501—4.5839 mi. Clinton Co. and 5.541 mi. Licking Co., to R. P. Sebold Eng. Co., West Riverview St. and Pennsylvania R.R., Dayton, $79,143 and $189,760 respectively—7.596 mi. Paulding and Defiance Counties, to L. L. Clymer, Bluffton, $258,365—6.072 mi. Gallia Co., to Frowine Bros., Inc., Portsmouth, $135,179—4.08 mi. Jackson Co., to Brewer & Brewer Sons, Chillicothe, $122,882—0.39 mi. Mahoning Co., to M. DeBartola, Youngstown, $13,995—1.198 mi. Washington Co., to A. K. Grandle, Leesburg, $65,752—widening, replacing concrete 5.069 mi. Champaign Co., to Studebaker & Son, Greenville, $44,328—concrete paving, constructing three 45 ft. spans, concrete beam bridge, 0.323 mi. Medina Co., to J. Hill, Ada, $55,449—brick paving, incl. furnishing, delivering brick, 7.35 mi. Stark Co. and 5.003 mi. Summit Co., to Cleveland Trinidad Paving Co., 700 Western Reserve Bldg., Cleveland, $658,913 and $314,-814 respectively—concrete slab bridge Auglaize Co. and concrete beam bridge Clark Co., to V. H. Mertz, St. John's, 6,947 and $16,905 respectively. Grand total, $2,332,448. Noted Apr. 2.

O., Cleveland—Grading, stone curbing, sheet asphalt (oil) surfacing 10,060 sq.yd. Fulton Rd., to Roehl Bros. Constr. Co., 7002 Denison Ave., $65,984. Noted Mar. 26.

O., Cleveland — Grading, stone curbing, oil asphalt surfacing 4,460 sq.yd. Carnegie Ave., to F. W. Stollfus, 1926 Schaaf Rd., $18,622—grading, stone curbing, brick paving 1,210 sq.yd. East 85th St., to H. G. Herring, Wayside Rd., $5,621. Noted Mar. 26.

O., Parma (br. Cleveland)—Stone curbing, concrete paving 7,500 sq.yd. Keystone Rd. and Oxford Dr., to Baldwin Bros., Union Trust Bldg., Cleveland, $23,638 and $6,674 respectively. Noted Apr. 9.

Pennsylvania—State Hy. Dpt., Harrisburg, grading, waterbound macadam surfacing 89,321 sq.yd. Wyoming Co., to Connell & Laub, Dayton, O., $295,320—grading, concrete surfacing 3,620 sq.yd. Armstrong Co., to State Constr. Co., New Kensington, $20,658—12,400 sq.yd. Chester and Lancaster Counties to Suburban Constr. Co., Ardmore, $40,186—4,454 sq.yd. Blair Co., to E. C. Stall, Altoona, $15,643. Grand total $371,807. Noted Apr. 2.

Pa., Phila.—See "Sewers."

Pa., Phila.—Bureau Hys., Dpt. P. Wks., City Hall Annex, A. Murdock, dir., to F. Mark Constr. Co., Custer Ave. and Winghocking St., grading, improving Cottman Ave. from New York Short line of Reading Company to Elm Ave. $25,297—to Union Paving Co., Broad and Stiles Sts., asphalt paving (assessment work) Ashdale St. from railroad to Front St. $11,956; Ditman St. from McMenamy to Hartel Sts. $4,016; Duncannon St. from Mascher to Front Sts. $7,582; G St. from Venango to Erie Sts. $11,038; G St. from Huntington Park to Annsbury St. $25,369; Knorr St. from Roosevelt Blvd. to Brouse St. $8,365; Saul St. from Bridge to Brill Sts. $2,996; 12th St. from Spencer to summit of Champlost St. $8,273; asphalt repaving Christian St. from 9th to 10th Sts. and from 11th to 12th Sts. $8,670; country road improving Newton St. from Passmore to Gilham Sts. $2,424—to Eastern Asphalt Co., Pennsylvania Bldg., asphalt paving (assessment work) C St. from Ontario to Tioga Sts. $3,736; Wayne St. from Arbutus to Carpenter Sts. $18,586; asphalt repaving Chew St. from Mt. Airy to Mt. Pleasant Sts. $10,236; Mt. Airy St. from Germantown to Boyer Sts. $12,039; repressed granite block repaving Susquehanna St. from 2nd to 3rd Sts. $9,447; country road improving Bean St. from Shawmont to Minerva Sts., Eva St. from Shawmont to Dearnley Sts. and Minerva St. from Eva to Bean Sts. $6,268—to Asphaltic Ref. Co., 260 South Broad St., furnishing, delivering oil for mosquito elimination $1,750—to Lumber Serv. Co., 3725 Market St., furnishing, delivering lumber $4,527—to R. De Cou Co., 11th and Hamilton Sts., furnishing, delivering structural steel (warehouse stock) $2,174—to Compressed Air Ser. Corp., 5531 Harverford Ave., repairs to compressor, $165—to R. Patterson & Son, 24th and Cherry Sts., furnishing, delivering portland cement,

Streets and Roads (Continued)

$370; grout sand $150; paving gravel $150—to J. J. McHugh, 1617 Race St., furnishing, delivering hard sewer brick $199. Grand total $185,783. Noted Mar. 26.

Rhode Island—State Bd. P. Roads, Providence, rein.-con. paving 8 mi. North Kingstown, Exeter and South Kingston, 20 and 40 ft. and 3 mi. Contr. 3105, East Providence, 28-38 ft., to Lane Constr. Corp., 134 State St., Meriden, Conn., $361,935 and $147,079 respectively; premixed bitulithic concrete on concrete paving 1 mi. Contr. 3109, West Warwick, to B. C. Jordan, Providence, $36,329. Grand total $545,343. Noted Mar. 26.

S. D., Sioux Falls—Bd. City Comrs., at office W. C. Leyse, aud., curbing, guttering, concrete paving 1,440 sq.yd. Walts Ave., curbing, guttering Trap Ave., and concrete paving 7,102 sq.yd. 3rd St., to Queens City Constr. Co., Sioux Falls, $20,145. Noted Mar. 12.

Virginia—State Hy. Dpt., Richmond, grading, drainage structures, concrete surfacing 2.6 mi. road in Arlington and Fairfax Counties, to Carson & Gruman, 33rd and K Sts. N. W., Wash., D. C., $66,606—3.95 mi. Spotsylvania Co., to Virginia Constr. Co., Fredericksburg, $48,983 — grading, drainage structures, one course macadam surfacing, also bridge over Clinch River, Wise Co., to M. S. Huggins, Roanoke, $33,254 — 1.2 mi. Wythe Co., to Wytheville Haymes Constr. Co., Chatham, $56,683—soil surface treatment 1.17 mi. Fluvanna Co., to C. A. Ragland, Louisburg, N. C., $16,682—surface treatment roads, also bridge over Goldenvale Creek, Caroline Co., to J. I. Hicks & Bros., Evington, $8,564. Grand total $230,772. Grading, drainage structures, surfacing 4.4 mi. road in Princess Anne Co., from F. J. McGuire, Norfolk, $120,843. Noted Mar. 19.

Wisconsin—State Hy. Comn., Madison, grading 7.37 mi. Dodge Co., to M. Wunderlich, 724 Snell Ave., Minneapolis, Minn., $122,374—6.6 mi. Columbia Co. and road in Monroe and Jackson Counties, to Nelson, Mullen & Nelson, 355 Gateway Bank Bldg., Minneapolis, Minn., $82,497 and $75,573 respectively—3.53 mi. Pepin Co., to Barnard-Curtis Co., 504 Globe Bldg., Minneapolis, Minn., $50,112—road in Grant and Lafayette Counties, to F. Kutzke, Brooklyn, $25,339—Dubuque-Platteville Rd., and Mount Ida-Fennimore Rd., both Grant Co., to M. J. Groves & Son Co., 529 South 7th St., Minneapolis, Minn., $59,300 and $48,072 respectively—road in Grant Co., to G. Needham, Fennimore, $17,955—3.823 mi. Trempealeau Co., to Williams & Williams, Strum, $41,382—10.25 mi. LaCrosse Co., to A. C. Dixon, 325 Gilfillian Bank Bldg., St. Paul, Minn., $44,396—10.253 mi. Eau Claire Co., to P. C. Kroeck, Milwaukee, $178,606—Option B same road, to Lex Constr. Co., West Allis, $210,809—grading, shale surfacing 2.989 mi. Dunn Co., to L. A. Baumgardner & Co., St. Paul., Minn. $38,357. Grand total $994,772. Noted Mar. 19.

EXCAVATION, DRAINAGE, IRRIGATION, LEVEES, RIVER AND HARBOR

PROPOSED WORK

N. J., Long Branch — Bd. City Comrs., City Hall, preliminary plans 2 stone jetties on ocean front, south of Morris Ave. $25,000. O. R. Seaman, 442 Dewey St., engr.

BIDS ASKED

Calif., Turlock—May 4, by A. Sorensen, secy. Turlock Irrigation Dist. 67,315 sq.ft. 2 in. concrete canal lining, 50.09 cu.yd. concrete in structures.

Ill., Chicago—Apr. 29, South Park Comrs., 5700 Cottage Grove Ave., bulkheads for extension Northerly Island from 18th to 23rd Sts., which adds 12.8 acres to 70 acre island, site for World's Fair. E. J. Kelley, pres. Noted Feb. 12.

N. Y., Buffalo—Apr. 30, by G. Fisk, comr. P. Wks., Municipal Bldg., 437 ft. extension Bird Island Pier Impvt. retaining wall only in Niagara River northerly; dredging Buffalo Inner Harbor, for channel maintenance July 1 to June 30, 1932.

N. Y., North Tarrytown—May 4, by Westchester Co. Park Comn., 72 West Pondfield Rd., Bronxville, 150,000 cu.yd. dredging, filling Kingsland Point Park, Contr. 354. J. Downer, ch. engr.; adv. E. N.-R. Apr. 23.

CONTRACTS AWARDED

Fla., Boynton—R. R. McCormick, Roosevelt Rd., Chicago, Ill. and Boynton, 2,000 lin.ft. concrete gravity seawall on steel sheet piling, and dredging 75,000 cu.yd. loose material from Lake Worth, seawall and Groynes, to G. O. Reed, Inc., Miami Beach, $175,000

La., New Orleans—State Bd. Engineers, constructing 12,000 ft. Reid-Biggs Canal, incl. 53,000 cu.yd. excav., and 6,800 ft. Reid-Bedford Canal, 27,000 cu.yd. excav., both Madison Parish, to Midland Constr. Co., Clarksdale, Miss., at $0.915 per cu.yd.; constructing Grand Bend New Levee, 10,000 cu.yd. excav., Rapides Parish, to J. E. Firman, Rosa, $0.22. Noted Apr. 2.

N. Y., New York—M. Cosgrove, comr. Docks, Pier "A", Battery Pl., dredging, removing rock, and overlying material south side Pier 3, North River, to Great Lakes Dredge & Dock Co., 17 Battery Pl., $11,250. Noted Feb. 19.

Va., Richmond—Dpt. P. Wks., City Hall, excavating, trenching, refilling trenches for gas and watermains, to A. E. Cheatwood, 4500 Cutshaw Ave., $16,213.

Bond Elections

Coming Bond Elections

Waterworks Improvements — Fairfield, Calif., $42,500. A. N. Jensen, 68 Post St., San Francisco, engr.

Distributing System, Pumping Unit, etc. — Beaumont, Tex., election in fall. R. C. Black, engr. $1,000,000.

Waterworks Improvements — Gunnison, Utah, May 9. $30,000.

Airports—Rapid City S. D., April 21. $50,000.

Park Improvements, Pool, etc.—Beaumont, Tex., May 28. $100,000.

Branch Libraries—Los Angeles, Calif. $1,000,000.

Detention House—Independence, Mo., May 26. $250,000.

Court House—Kansas City, Mo., May 26. $4,000,000.

School—Worthington, Maine, May. $200,000.

Schools—Spanish Fork, Utah. $250,000.

High School—Johnson City, Wyo. $175,000.

Bonds Voted

High School—Albion, N. Y. $390,000.

School—San Marcos, Tex. $200,000.

Bonds Defeated

Schools and additions—St. Paul, Minn. $975,000.

Court House—Lincoln County, Neb. $150,000.

FEDERAL GOVERNMENT

PROPOSED WORK

Calif., Oakland—GRADING—Pub. Rds., foot Dennison St., grading 56,000 cu.yd. in connection with Government Island Project.

Ia., Sioux City—DIKES—U. S. Eng., 3,850 lin.ft. dikes and 200 lin.ft. in Missouri River, at Sioux City Bend.

Mass., Franklin—POST OFFICE—Treas. Dpt. at office Sup. Archt., 2 story, basement post office. $85,000.

Mass., Salem—POST OFFICE—Treas. Dpt. at office Sup. Archt., 1 story, basement post office, Norman St. and Margin Court. $360,000.

Nev., Boulder City — TOWN HALL, etc. — Bureau Reclamation, Denver, Colo., town hall, school, garages, dormitory, guest house, 75 cottages, 50 small garages, swimming pool. R. F. Walter, Denver, Colo., ch. engr.

Tex., Galveston—IMMIGRATION STATION—Treas. Dpt. at office Sup. Archt., plans by Bottomley, Wagner & White, 60 East 42nd St., New York, immigration station, Avenues A and B between 17th and 18th Sts. $375,000. Noted Mar. 12.

Wash., Seattle—DREDGING—U. S. Eng. soon takes bids 1,000,000 cu.yd. Duwamish Waterway. $190,000. King Co. voted emergency appropriation $95,000 to proceed with work. Cost to be borne equally by Govt. and King Co.

BIDS ASKED

Calif., San Diego—DERRICKS—Spec. 6460—Apr. 29 by Yards & Docks, Navy Dpt., two 25 ton floating steel derricks, stiff leg type, with bull wheel, having steel pontoons, steam engines and oil burning boilers, one delivered to Mare Island, other to San Diego.

Fla., Lake City—POST OFFICE—May 14, by Treas. Dpt. at office Sup. Archt., constructing U. S. Post Office; adv. E. N.-R. Apr. 23.

Ill., Rock Island—LEVEES—May 1, by U. S. Eng., Federal Bldg., levees, Mill Creek cut-off and South Slough excavation (Item 1), constructing spillways, culverts (Item 2) Mill Creek Diversion Project; adv. E. N.-R. Apr. 23.

Mass., Chelsea—REFRIGERATING PLANT—Spec. 6452—Apr. 29, by Yards & Docks, Navy Dpt., refrigerating and ice making plant, incl. motor driven compressors, condenser, pumps, tanks, blower, ice crane, chutes, refrigerator and storage room, at Naval Hospital.

Mass., Springfield—BOILER PLANT—Apr. 28 (extended date), by Con. Q.M., Springfield Armory, replacing steam boiler plant, incl. altering boiler plant building, providing support for dust collection equipment, erecting chimney, installing oil burning plant at Hill Shops, Springfield Armory. Noted Apr. 2.

Mo., Springfield — HOSPITAL — Bureau Prisons, Dpt. Justice, bids about July 15, rein.-con., brick, stone hosptial. $2,500,000. Architect not selected. Noted Apr. 16.

N. J., Fort Monmouth—APARTMENT, etc.—May 15, by Con. Q. M., one 4 family apartment, 8 company officers and 7 double non-commissioned officers quarters. $290,000. Noted Mar. 12.

Pa., Wellsboro—POST OFFICE—May 11, by Treas. Dpt. at office Sup. Archt., U. S. Post Office.

Tex., Coleman—POST OFFICE—May 12, by Treas. Dpt., at office Sup. Archt., U. S. Post Office.

Tex., Sweetwater—POST OFFICE—May 12, by Treas. Dpt. at office Sup. Archt., U. S. Post Office.

Tex., Waco—ELEVATORS—Apr. 28, by Vet. Bu., Arlington Bldg., furnishing, installing electric elevators for U. S. Veterans' Hospital. Former bids rejected.

Wyoming—ROAD—Apr. 27, by Pub. Rds., 301 Custom House, Denver, Colo., scarifying, oil processing roadbed 207,000 sq.yd. East Entrance Natl. Park Hy., and 24 mi. Grand Loop Natl. Park Hy., Yellowstone Natl. Park. A. E. Palen, Denver, Colo. dist. engr.

Alaska — ROAD — May 7, by Pub. Rds., Juneau, or A. G. C. Bureau, Multnomah Hotel, Portland, Ore., grading 1.534 mi. Yakuntat Hy., 1st Judicial Dist. M. D. Williams, Juneau, dist. engr.

Alaska — ROAD — May 8, by Pub. Rds., Juneau, or A. G. C. Bureau, Multnomah Hotel, Portland, Ore., grading Kake Hy., 1st Judicial Dist. M. D. Williams, Juneau, dist. engr.

CONTRACTS AWARDED

Arizona—ROAD—C .H. Sweetser, dist. engr. Pub. Rds., Phoenix, oil processing 27.97 mi. Grand Canyon-Old Trails Natl. Forest Rd., Coconino Co., to J. Casson, Hayward, Calif., $134,145. Est. $154,754. Noted Mar. 19.

Calif., Riverside — GRADING, etc. — Con. Q. M., March Field, grading, oiling runways at March Field, to G. Gardner & Sons, Redlands, $13,238; power and lighting machine shops, repair shops, hangar, to Knight Bennett & J. J. Taylor, Los Angeles, $8,897; heating in machine shops, to Hickman Bros., San Pedro, $6,043. Grand total $28,178.

Calif., Riverside—QUARTERS—Con. Q. M., March Field, 36 non-commissioned officers quarters, to C. T. and W. P. Stover, Claremont, $176,870. Noted Mar. 5.

Conn., New London—LABORATORY—Spec. 6429 — Yards & Docks, Navy Dpt., engine laboratory at Naval Submarine Base, to T. Perrone, Inc., 1026 Main St., Hartford, $24,593. Noted Apr. 7 Daily.

Ga., Fort Benning—QUARTERS—Con. Q. M., 51 field officers and 51 company officers quarters, to Rogers & Leventhal, Inc., 822 East 11th St., Chattanooga, Tenn., $560,783. Noted Apr. 2.

Ind., Fort Benjamin Harrison—QUARTERS—Con. Q. M., 2 double non-commissioned officers quarters, to American Constr. Co., 1201 East Georgia St., Indianapolis, $28,478; 4 company officers quarters, to H. S. Ikerd, Bedford, $48,581. Noted Apr. 9.

La., New Orleans—LEVEE—U. S. Eng., 3,720,000 cu.yd. levee work in Tensas Levee Dist. on Mississippi River, to H. B. Blanks, Talleulah, $653,650.

Md., Fort George Meade—QUARTERS—Con. Q. M., 6 non-commissioned officers quarters, to J. M. Kisner & Bro. Lumber Co., Fairmont, W. Va., $39,819. Noted Mar. 5.

Md., Fort Hoyle—QUARTERS—Con. Q. M., 2 double sets non-commissioned officers quarters, to R. G. Hopkins, Baltimore, $14,460. Noted Mar. 5.

Mich., Fort Wayne—QUARTERS—Con. Q. M., 3 double sets non-commissioned officers quarters, to G. H. Leverenz, 201 South Lakewood Blvd., Detroit, $37,093. Noted Mar. 12.

N. J., Camden—POST OFFICE, etc.—Treas. Dpt. at office Sup. Archt., U. S. Post Office, Court House, to Agostini Bros., 205 42nd St., New York, $448,691. Noted Apr. 2.

N. Y., Mineola—QUARTERS—Con. Q. M., Mitchell Field, 6 double non-commissioned officers quarters, to Brooklyn & Queens Screen Mfg. Co., Inc., Rockaway Blvd., South Ozone Park, Brooklyn, $85,272. Noted Mar. 5.

N. C., Kitty Hawk—ROAD—Con. Q. M., sand and asphalt approach road to Wright Memorial, to R. G. Lassiter & Co., Raleigh Bank & Trust Bldg., Raleigh, $19,719.

S. C., Parris Island— PAVEMENT — Spec. 6463—Yards & Docks, Navy Dpt., paving rifle range, to Samford Bros., Montgomery, Ala., $36,653. Noted Apr. 2.

Tenn., Memphis—DREDGING—U. S. Eng., Memphis, to Noble, Crow & Lawrence, Fayette, Miss., 960,000 cu.yd. earthwork in Upper Yazoo Levee Dist. $158,400, 910,000 cu.yd. same district $150,150, 680,000 cu.yd. same district $112,200; to E. F. Powers Constr. Co., 318 Harvey Bldg., West Palm Beach, Fla., 1,870,000 cu.yd. same district $269,280; to Canal Constr. Co., Box 1516, 1,200,000 cu.yd. White River Levee Dist., $326,400; to W. F. Price, Inc., Miami, Fla., 1,510,000 cu.yd. White River Levee Dist. (new) $330,690; to L. A. Wilson & Co., Inc., Ottawa, Ill., 900,000 cu.yd. same district $221,400; to J. J. McCaughey Co. & States Constr. Co., 205 West Wacker Dr., Chicago, Ill., 200,000 cu.yd. Upper St. Francis Levee Dist., $34,800; to Brooks Calloway Co., 1522 Healey Bldg., Atlanta, Ga., 2,550,000 cu.yd. same district $344,250. Grand total $1,947,570. Noted Mar. 12.

Utah—ROAD—Pub. Rds., Ogden, grading, 11.716 mi. Sevier-Cove Fort, Natl. Forest Rd., Sevier Co., to Gibbons & Reed, Continental Bank Bldg., Salt Lake City, $130,751. Est. $182,000. Noted Apr. 2.

Va., Fort Humphreys—SIDEWALKS, etc.—Con. Q. M., sidewalks, grading, at non-commissioned officers area, to Boatwright, Russel & Linton, Manassas, $12,273.

Va., Langley Field—ELECTRICAL DISTRIBUTION SYSTEM, etc.—Con. Q. M., electrical distribution system, to S. J. Watson, Jr., Hampton, $4,724; municipal water and sewer lines, to Bickelhaupt, Inc., Amer. Natl. Bank Bldg., Richmond, $4,998.

Va., Langley Field — SEWAGE DISPOSAL PLANT—**Con. Q. M., Fort Monroe**, sewage disposal plant at Heavier-than-Air-Section, to W. C. Spratt, Fredericksburg, $39,990. Noted Jan. 22.

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Federal Government Work (Continued)

Wash., Fort Lewis—QUARTERS—Con. Q. M., 6 field officers and 27 company officers quarters, to MacDonald Constr. Co., Tacoma, $419,907. Noted Mar. 12.

Wyoming—ROAD—Pub. Rds., 301 Custom House, Denver, Colo., grading, draining, surfacing 12.41 mi. Hoback Canyon Natl. Forest Rd., Teton Natl. Forest, Sublette Co., to Peterson, Shirley & Gunther, 1411 W. O. W. Bldg., Omaha, Neb., $ 11,477. Noted Feb. 19.

RAILWAYS

PROPOSED WORK

Kentucky — Chesapeake & Ohio R.R. Co., Richmond, Va., C. W. Johns, ch. engr., terminal yards addition, classification yard, graveling road from Worthington to Russell, closing underground crossing. $525,000.

Oregon—Great Northern Ry., J. R. W. Davis, St. Paul, Minn., surveys 14.3 mi. railroad on east side Deschutes River from Bend to Lava.

Texas—Winter Garden Belt Ry. Co., c/o J. G. Sullivan, Eagle Pass, and Asherton, 70 mi. standard gage railroad from Asherton to Eagle Pass, thence through 160,000 acre plot ground. $300,000. Private plans.

CONTRACTS AWARDED

Colorado—Atchison, Topeka & Santa Fe R.R. Co., c/o W. W. Kelly, ch. engr. (Western Lines), Amarillo, Tex., relocating, rebuilding 1.5 mi. track through lower Park Hill, in Pueblo, incl. 2 subways, to Arthur & Allen, 409 North Grand Ave., Pueblo. Est. $250,000.

SUBWAYS AND TUNNELS

CONTRACTS AWARDED

Pa., Phila.—Dpt. City Transit, C. E. Myers, dir., City Hall, Annex, Contr. 205, portion Broad Street Subway from South St. to South Snyder Ave., incl. 7,285 lin.ft. 2 track subway, 3 passenger stations of Island platform type, underpass for future track at Passyunk Ave., to Jafolla & Marks, 2820 North 21st St., $3,885,629. Noted Mar. 19.

GRADE CROSSINGS

PROPOSED WORK

N. Y., Cobleskill—Delaware & Hudson R.R. Co., J. MacMartin, ch. engr., Albany, eliminating grade crossings at West Main St., Ryder and Washington Aves. $252,470.

N. Y., Herkimer—New York Central R.R. Co., F. B. Freeman, ch. engr., 366 Lexington Ave., New York, eliminating grade crossing Protection Ave., Caroline, Bellinger, Prospect, Main, Washington and King Sts. $2,665,600.

BIDS ASKED

Ind., Huntington—May 1, by Bd. P. Wks., City Hall, undergrade crossing, 4 lane hy. 450 ft. long, State Roads 9 and 24, for Erie R.R. Co., 50 Church St., New York, G. S. Fanning, ch. engr., and City, P. V. Smith, Huntington, engr.

CONTRACTS AWARDED

N. Y., Cambridge—Delaware & Hudson R.R. Co., J. MacMartin, ch. engr., Albany, eliminating North Park Ave. Crossing, to Wilson & English Constr. Co., 50 Church St., New York, $70,088. Est. $102,818.

N. Y., Phelps—New York Central R.R. Co., 466 Lexington Ave., New York, eliminating Junius-Waterloo Hy. Crossing, south of Junius Station, to Walsh Constr. Co., Herald Bldg., Syracuse, $61,724. Est. $91,036.

N. Y., Schenectady—Delaware & Hudson R.R. Co., J. MacMartin, ch. engr., Albany, eliminating Campbell Ave., Mill and Fort Hunter Rds. Crossings, in town of Rotterdam and city of Schenectady to J. A. McCormick Co., Easton, Pa., $45,678. Est. $54,706.

O., Toledo—Chesapeake & Ohio R.R. Co., C. W. Johns, ch. engr., Richmond, Va., rein.-con. grade crossing elimination, to Walsh Constr. Co., 1206 New City Tr., Indianapolis, Ind. Est. $500,000.

DAMS

CONTRACTS AWARDED

Tex., Burnet — Emery, Peck & Rockwood Development Co., 208 South La Salle St., Chicago, and Scarborough Bldg., Austin, Hamilton Dam, multiple arch type, on Colorado River, in connection with Hamilton Hydro-Electric Project, here, involving 130,000 yd. rein.-con., to Fegles Constr. Co., Ltd., 711 Wesley Temple, Minneapolis, Minn.; constructing power transmission line from Marble Falls to site of dam, to L. E. Myers Co., Allen Bldg., Dallas. Est. $6,000,000. Noted Jan. 22, under "Marble Falls."

PIERS AND WHARVES

PROPOSED WORK

Mass., Gloucester — FISH PIER — Commonwealth of Massachusetts, Dpt. P. Wks., State House, Boston, fish pier, concrete, steel. $685,000. F. L. Sellew, State House, Boston, engr. Gloucester Fish Pier Corp., lessee.

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N. Y., Charleston (sta. Staten Island)—PIER—Standard Oil Co. of New York, 26 Bway., New York, lets contract about July 1, 226 ft. timber pier with timber pile work clusters. $25,000. Project in abeyance. Noted Mar. 26.

BIDS ASKED

N. Y., New York—PIER—Apr. 23, by M. Cosgrove, comr. Docks, Pier "A," Battery Pl., reconstructing pier, foot East 30th St., East River, Contr. 2037. Noted Mar. 19.

Va., Richmond—WHARVES—May 4, at office R. K. Compton, dir. P. Wks., 220 lin.ft. gravity type concrete wall with alternate of rein.-con. platform type on concrete piles, also 300 lin.ft. creosoted timber wharf; adv. E. N.-R. Apr. 23.

CONTRACTS AWARDED

Mich., Marquette—ORE DOCK and PIER—Duluth, South Shore & Atlantic Ry., E. A. Whitman, ch. engr., Minneapolis, Minn., 968 ft. rein.-con. ore dock, to Merritt, Chapman & Whitney Corp., Duluth, Minn. Est. $1,500,000.

AIRPORTS

PROPOSED WORK

Mass., Norwood — Massachusetts Air Terminal & Arena, H. E. Shaw, trustee, Norwood, preparing plans 80 x 100 ft. administration building, hangar; grading, draining in charge of C. Kenniston, 14 Meadow St., engr. Total est. $1,000,000. Merick & Wildish, 1525 East 53rd St., Chicago, Ill., consult. engrs. Noted Jan. 22.

N. Y., Rossville (sta. Staten Island) — Corporation, c/o M. Scardaccione, 2 Delafield Pl., Port Richmond, hangar, aviation field, school. $40,000 or more.

CONTRACTS AWARDED

Calif., Sacramento—City Council, steel, timber hangar, to Campbell Constr. Co., 800 R St., $52,486. Noted Apr. 16.

Conn., Hartford—City, Bd. Contr. & Supply, filling, grading aviation field, South Meadows, to Nott Plant Co., Columbus Ave., Meriden, $6,048. Noted Apr. 16.

GRAIN ELEVATORS

PROPOSED WORK

Kan., Kansas City—GRAIN ELEVATOR—Chicago, Rock Island & Pacific R.R. Co., La Salle St. Sta., Chicago, Ill., W. H. Petersen, ch. engr., sketches 1,400,000 bu. rein.-con. addition, near 7th St. and Kansas Ave. A. T. Hawk, La Salle St. Sta., Chicago, Ill., engr. Simonds-Shields-Lonsdale Grain Co., Bd. Trade Bldg., Kansas City, Mo., lessee.

Mo., Kansas City—GRAIN ELEVATOR—Chicago, Rock Island & Pacific Ry. Co., W. H. Petersen, ch. engr., LaSalle St. Sta., Chicago, Ill., grain elevator. $325,000. Private plans.

Okla., Blackwell—GRAIN ELEVATOR—Midland Flour Milling Co., Bd. of Trade Bldg., Kansas City, Mo., preliminary plans 400,000 bu. rein.-con. addition to grain elevator Horner & Wyatt, 468 Bd. of Trade Bldg., Kansas City, Mo., engrs.

POWER AND LIGHTING

PROPOSED WORK

Conn., New Britain—City, P. Wks. Dpt., subways for electric wires. $200,000. W. Merriam, City Hall, engr.

Mo., Boonville—Missouri Power & Light Co., 740 Bd. Trade Bldg., natural gas distribution system. Private plans. City voted 14 year franchise.

New York—Niagara & Hudson Power Co., Warren St., Syracuse, 38 mi. artificial gas pipe line from Oswego to Syracuse, and gas mixing plant. To exceed $300,000. **Maturity soon.**

Okla., Nowata — City defeated franchise, natural gas distribution system to Pub. Serv. Co., 600 South Main St., Tulsa. $50,000. Private plans.

Tex., De Leon—For 20,000 ft. 4- to 6-in. c.i. pipe for natural gas system. $15,000-$25,000 election soon for same.

Que., Montreal—Montreal Light, Heat & Power Constr., 107 Craig St. W., 30 mi. high pressure gas mains, connecting Hockelage and Lasalle plants. $1,500,000.

BIDS ASKED

Iowa—See "Contracts Awarded."

Maryland—Apr. 28, by State Roads Comn., Baltimore, G. C. Uhl, chn., all electrical work necessary for power line and lighting system in bridge (now under construction) over Nanticoke River, Contr. D-71-17, Dorchester Co.; adv. E. N.-R. Apr. 23.

N. Y., Valhalla—May 5, by Westchester Co. Park Comn., 72 West Pondfield Rd., Bronxville, electric lighting Bronx Parkway extension at Kensico Plaza. J. Downer, Bronxville, ch. engr.; adv. E. N.-R. Apr. 23.

CONTRACTS AWARDED

Iowa—Iowa-Nebraska Power & Light Co., 14th and O Sts., Lincoln, Neb., 50 mi. 6,600 volt, single phase lines, transformers, services, meters, to serve 140 farm customers in Shelby, Fremont, Pottawattamie & Harrison Counties, own forces. R. L. Schacht, c/o owner, engr. $60,000.

N. Y., New York—Bd. Higher Educ., Main Bldg., 139th St. and Convent Ave., electrical work Main Centre, City College, to Jandus Electric Equipment Co., 210 East 40th St., $143,330. Noted Mar. 6 Daily.

Tex., Burnet—See "Dams."

PARKS AND SPORTS

PROPOSED WORK

Mass., Fairhaven—I. Dawson, 634 Pleasant St., New Bedford, soon takes bids 1 story, brick golf course, clubhouse, Washington St., $50,000 or more. D. J. Ross, Little Compton, R. I., archt. Noted Nov. 6.

N. J., Clifton—Bd. City Council, City Hall, concrete wading pool at Nash Pond Park, $25,000. J. Fitzgerald, city engr.

N. J., Jersey City — Hudson County Park Comn., 921 Bergen Ave., revised preliminary plans removing athletic field in Lincoln park, constructing new field, incl. grading, sodding, concrete work, handball courts, baseball field, in rear park, west of state hy. $50,000. Private plans. Noted Mar. 26.

N. J., Leonia—Bd. Boro Council, Boro Hall, concrete tile swimming pool, in Wood Park, $25,000. A. W. Gill, Park and Central Aves., boro engr.

O., Cleveland — National Air Races, C. Gildersleeve, 227 Superior Ave., steel, timber grandstand, 30,000 seating capacity at airport, $40,000. Private plans.

Tex., San Antonio—See "Clubs."

BIDS ASKED

Ill., Chicago—Holabird & Root, archts., 333 North Michigan Ave., taking bids 1 story, stone field house, 56th St. and University Ave., for University of Chicago, 122 South Michigan Ave. $500,000.

Mass., Boston—Apr. 24, by Park Dpt., 33 Beacon St., municipal golf course, West Roxbury and Hyde Park, $275,000. Former bids rejected. Noted Apr. 2.

N. J., Newark—Dept. P. Wks., City Hall, bids about May 1, altering and constructing 1 story, basement brick, steel, public bath building addition, Paterson St. and Wilson Ave. $150,000. J. C. Acocella, 9 Clinton St., archt.

N. Y., Brooklyn—Apr. 28, by Dpt. Parks, W. R. Herrick, pres. Park Bd., Arsenal Bldg., Central Park, New York, improving Shore Road Drive Park between Colonial Rd. and 4th Ave.; improving grounds around Children's Museum, Brower Park, at Brooklyn Ave. and Park Pl.

N. Y., Massapequa — See "Contracts Awarded."

N. Y., New York—Apr. 28, by Park Bd., W. R. Herrick, pres. Park Dpt., Arsenal Bldg., Central Park, removing loose rock from rock cut on westerly side Harlem River Driveway between 155th and Dyckman Sts.; furnishing, erecting (except electrical work) 5 additional greenhouses, Central Park, opposite East 104th St.

CONTRACTS AWARDED

Mass., Leominster—City, B. W. Doyle, 511 Lancaster St., steel, concrete bleachers, to J. L. Hammett Co., 290 Main St., Cambridge. Est. exceeds $25,000. Noted Apr. 2.

Mass., Leominster — Doyle Athletic Field Comn., B. W. Doyle, 511 Lancaster St., 2 story, 35 x 90 ft., brick, concrete club house, to Profit & White Constr. Co., 1137 Main St. Contract for stadium, tennis courts, athletic field and landscape work, to be awarded later. Total est. $400,000. Noted Apr. 2.

Mass., Mattapoisett—Reservation Golf Club, Inc., Mattapoisett, golf course improvements, incl. club house, to J. Owers, 143 Clinton St., New Bedford. Est. exceeds $25,000. Noted Mar. 5.

N. J., East Orange—Bd. Educ., 19 Winans St., grading, fencing, installing seats, Ashland Stadium, to Benigno & Delapella, Inc., 250 Springfield Ave., Newark. Est. $25,000. Noted Mar. 30.

N. Y., Massapequa—C. W. Beall and Long Island Zoological Park, Oceanside, amusement park, zoo, day labor and separate contracts. To exceed $150,000.

Que., Montreal—City, public bath, St. Gabriel Ward, to St. George Cartage & Constr. Co., Ltd., 4820 4th Ave., Rismont, $103,226.

HEATING AND VENTILATING

BIDS ASKED

Ill., Chicago—Apr. 28, by Bd. Educ., 188 West Randolph St., E. Withall, bus. mgr., oil heaters for sundry field houses, new boilers Columbus and Jackson Schools, new boilers and oil burners Old Lane School, new boilers and stokers, Garfield School, plumbing, Schurz and Austin High Schools. J. C. Christensen, 188 West Randolph St., archt.

Ind., Lafayette — May 5, by Bd. Trustees Purdue University, addition to heating and power plant, incl. water piping, heating, plumbing, electric wiring, power piping. W. Scholer, Wallace Blk., archt.

N. J., Madison—Apr. 28, by Bd. Educ., High School, heating and plumbing work in Central Ave. School. $25,000. Guilbert & Betelle, 20 Branford Pl., Newark, engrs.

N. J., Rahway—Apr. 28, by Dpt. Institutions & Agencies, State Office Bldg., Trenton, furnishing, installing heating system, plumbing in 4 story, 50 x 268 ft. Main Building 1 for Prisoners. $25,000.

Heating and Ventilating (Continued)

CONTRACTS AWARDED

N. Y., New York—Bd. Educ., 500 Park Ave., heating in P. S. 103, to Almirall & Co., Inc., 53 Park Pl., $88,313; plumbing, to W. J. Endres, Inc., Grand Central Terminal, $27,000; electrical work, to Pyramid Electric Contg. Co., 228 East 41st St., $20,440. Grand total $135,753. Noted Mar. 19.

Ind., Indianapolis—Bd. Comrs., Indiana Central Insane Hospital 1,000 ft. tunnel 7 x 7 ft. inside, to F. H. Rosebrock, 4454 Washington Blvd.; piping work, to Callon Bros., 24 South Alabama St.; electric wiring in building, to Porter, Glore & Glass, 215 Hudson St.; electrical work in tunnel, to C. L. Smith, 122 South Pennsylvania St. Est. $35,000. Noted Mar. 26.

UNCLASSIFIED

PROPOSED WORK

Calif., San Francisco—PIER SHED—California State Harbor Comn., Ferry Bldg., steel, rein.-con. pier shed at Pier 23. $100,000. F. G. White, Ferry Bldg., engr.

N. J., West New York—WIDENING, etc.—Bd. Town Council, Municipal Bldg., widening, grading, sewers, curbing, sidewalks, paving Jackson St. between 13th and 15th Sts. $30,000. F. Oleri, 650 Bergen Ave., town engr.

New York—PIPE LINE—Sun Pipe Line, Inc., subsidiary Sun Oil Co., 1608 Walnut St., Phila., Pa., soon takes bids from selected list bidders 5 mi. pipe line from New York state line to Syracuse.

N. Y., Long Island City—PUMP HOUSE—Standard Oil Co., 26 Bway., New York, plans by S. Wortmann, 116 Lexington Ave., New York, 3 story, 47 x 47 ft. pump house, equipment, 5th St. and 6th Ave. $40,000.

Oklahoma—GAS PIPE LINE—Western Serv. Corp., 602 Braniff Bldg., Oklahoma City, E. R. Ernsberger, pres. 35 mi. 6 in. natural gas pipe line (steel) from Oklahoma City Oil Fields to Guthrie. $200,000. Private plans.

Pa., Kittanning—BULK PLANT, etc.—Gulf Refining Co., Frick Bldg. Annex, Pittsburgh, soon lets general or separate contract bulk plant, tank farm, warehouse, pump house, water and rail facilities, on Allegheny River. $300,000.

Pa., Parkersburg—FLOATING DOCK, etc.—Gulf Refining Co., Frick Bldg. Annex, Pittsburgh, 50 ft. floating dock, 25 ft. wide, in Ohio River below mouth Little Kanawha River, near here, also oil pipe lines from barges, dredging 3,400 cu.yd. material. To exceed $40,000. **Maturity soon.**

Pa., Pittsburgh — BANANA RIPENING BUILDING—W. D. Wiggins, engr. in charge, Pennsylvania Sta., soon lets contract brick, steel, Smallman St., for Pennsylvania R.R. Co., Pennsylvania Sta.

BIDS ASKED

N. Y., New York—ELEVATOR—L. F. Knust, archt., 369 Lexington Ave., bids about May 10, general contract altering hospital clinic, incl. elevators, equipment, 363 Lexington Ave., for W. E. Chatles, 369 Lexington Ave. $40,000. Noted Apr. 9.

N. Y., Oceanside—TANKS—See "Contracts Awarded."

O., Canton—COAL WASHING and DRYING PLANT—May 1, by J. Wynn., Jr., secy. Edgefield Coal Co., Belden Ave. S. E., 1 story, brick, rein.-con., 400 and 500 tons daily capacity, Belden Ave. S. E., $50,000. Private plans.

CONTRACTS AWARDED

Ga., Austell — TEXTILE VILLAGE — Clark Thread Co., W. H. Lostus, 260 Ogden St., Newark, N. J., textile village, housing project for employees of new thread mill (now under construction), to Fiske Carter Constr. Co., Greenville, S. C. Est. exceeds $200,000.

N. Y., New York—STABLES—Riverside Ice Co., 434 East 92nd St., 2 story stables, riding academy, to C. L. Fraser, 50 Bway. Est. $40,000. Noted Apr. 9.

N. Y., Oceanside—TANKS—Gulf Refining Co., 21 State St., New York, 2,000,000 gal. tank, distribution plant, day labor.

N. Y., Oneonta—FOUNDATION—Dpt. Educ., Education Bldg., Albany, found. for building at State Normal School, to C. F. McLean, 332 Water St., Binghamton. $23,400. Noted Apr. 16.

Pa., Erie—SAND WASHING PLANT—Erie Sand & Gravel Co., R. W. Potter, pres., found., bins, tunnels, conveyors, sand washing equipment, West Front and Sassafras Sts., to E. E. Austin & Son, 20th and Reed Sts.

MATERIALS

PROPOSED WORK

WATER PIPE—**Gridley, Calif.**—City Trustees will take new bids furnishing c.i. pipe, fittings. Former bids rejected due to error in advertising. Noted Feb. 19.

BIDS ASKED

ROAD OIL—**Colorado**—See "Streets and Roads."

PIPE, etc.—**Spirit Lake, Ia.**—Apr. 27, at office Auditor Dickinson Co., 1,000 lin.ft. 15 in., 1,000 lin.ft. 18 in., 800 lin.ft. 24 in. and 200 lin.ft. 30 in. corrugated metal or concrete pipe, also 1 car 3 x 12 in. by 16 ft. Standard sawn bridge plank. R. A. Furman, Spirit Lake, co. engr.

SAND, etc.—**Long Island City, N. Y.**—Apr. 27, by G. U. Harvey, pres. Queens Boro, Queens Subway Bldg., 20,000 cu.yd. sand; 250,000 gal. calcium chloride.

TRAFFIC SIGNAL POSTS, etc.—**New York, N. Y.**—Apr. 27, by P. J. Dooling, comr. Purchase, Municipal Bldg., traffic signal posts to Police Dpt., lumber piles, gravel and road material to Dpts. Correction, Parks-Bronx, Parks-Queens, and Plants & Structures.

TIES — **Cincinnati, O.** — Cincinnati Union Terminal Co., Temple Bar Bldg., bids opened about Apr. 25, 90,000 creosoted ties, 1,000,000 ft. B.M. switch ties; 1,500,000 ft. B.M. frame bridge ties. H. M. Waite, Temple Bar Bldg., engr.

STRUCTURAL STEEL, etc. — **Phila., Pa.** — Apr. 28, by C. E. Walsh, purch agt. for Pennsylvania R.R. Co., 15 North 32nd St., cinders and slag ballast; Contr. 13.1931, structural steel, Contr. 14.1931.

CONTRACTS AWARDED

POWER POLES—**Gridley, Calif.**—City Trustees, to J. L. Hall, Mills Bldg., San Francisco, ten 30 ft. Western Red Cedar poles 6 in. top, ½ in. butt treated at $4.39 each; six 55 ft. poles, 9 in. top $17.51; two 60 ft. poles, 9 in. top $23; 1 car load 40 ft. poles 8 in. top, ½ in. butt, treated $11.75. Noted Mar. 19.

GATE VALVES—**Los Angeles, Calif.**—City Purchasing Agent, three hundred fifty 4 in. standard screw gate valves, to Petroleum Equipment Co., 2800 South Alameda St., at $5.55 each.

CEDAR POSTS—**Quincy, Calif.**—Bd. Supervs. Plumas Co., 10,000 heart cedar posts 6 x 6 in. 7 ft. long, delivered on hy. near Beckwith, to Clover Valley Lumber Co., Beckwith. $1,500. Noted Mar. 19.

COPPER PIPE—**Baltimore, Md.**—Bd. Awards, copper pipe to Bureau Water Supply, for Mayor and City Council, to Baltimore Tube Co., 1301 Wicomico St., $13,938. Noted Apr. 2.

GRAVEL, SAND, etc.—**Newton, Mass.**—City, gravel and sand, to Central Sand & Gravel Co., 430 Central Ave., Needham, $19,050; loam and sod, to Charles River Sand & Gravel Co., Inc., Highland Ave., Needham, $4,250; crushed rock as specified, to West Roxbury Trap Rock Co., 10 Grove St., West Roxbury, $29,300.

ROAD GRAVEL—**Greenville, Miss.**—Washington Co., 7,000 tons road gravel, to Southern Sand & Gravel Co., Mendenhall, at $1.32 per ton; 4,000 tons, to Memphis Stone & Gravel Co., Exchange Bldg., Memphis, Tenn., $2.25; 7,000 tons, to W. T. Wynn & Associates, Greenville, at $1.34.

TAR—**Newton, N. J.**—See "Streets and Roads."

CEMENT—**Trenton, N. J.**—Dpt. Institutions & Agencies, State Office Bldg., Trenton, 10,500 bbl. cement, for Goshen, Cape May Co., to Allentown Portland Cement Co., Allentown, Pa., $24,885; 600 bbl. cement for Annandale Reformatory, to C. R. Camp, 10 South 18th St., Phila., Pa., and B. W. Farrington, Annandale, $1,043. Noted Mar. 5.

CEMENT — **Oklahoma** — State Hy. Comn., Oklahoma City, 500,000 bbl. cement, to Lehigh Portland Cement Co., 815 Commerce Bldg., Kansas City, Mo.; 50,000 bbl., to Lone Star Cement Co., of Texas, Santa Fe Bldg., Dallas, Tex.; 130,000 bbl., to Oklahoma Portland Cement Co., Ada; 120,000 bbl., to Dewey Portland Cement Co., Dewey, all cement in bulk at various places, average price $1.51 per bbl. Total cost 800,000 bbl. $1,227,800. Noted Apr. 9.

STEEL, GRAVEL, CEMENT, etc.—**Phila., Pa.**—See "Streets and Roads."

STRUCTURAL STEEL — **Phila., Pa.** — See "Sewers."

EQUIPMENT

PROPOSED WORK

DIESEL ENGINE — **Gridley, Calif.** — J. L. Lewis, city clk., rejected bids Mar. 9, Diesel engine to replace present inadequate steam plant standby service. Project postponed indefinitely. Noted Feb. 26.

GRADER BLADES—**Clarksdale, Miss.**—H. L. Talbert, purch. agt. Coahoma Co. purchasing car load grader blades. B. T. Collier, Clarksdale, co. engr.

STEAM TURBINE GENERATOR UNIT—**Stillwater, Okla.**—Oklahoma A. & M. College, preliminary plans 350 kw. steam turbine generator unit for power purposes. $30,000. P. Donnell, Stillwater, engr.

BIDS ASKED

TRANSFORMERS—**Los Angeles, Calif.**—Apr. 30, by T. Oughton, city purch. agt., two 5 kw., four 25 kw., one 3 kw. and four 20 kw. "Subway Type" and one three kw. "Pole Type" constant current regulating transformers, Spec. 2414.

TRACTORS—**Hibbing, Minn.**—City in market 2 tractors. A. Johnson, city clk.

TRUCK — **St. Peter, Minn.** — Nicollet Co., W. H. Holz, aud., in market 1 truck. L. W. Grace, St. Peter, engr.

AIR COMPRESSORS, etc.—**Brooklyn, N. Y.**—Apr. 29, by H. Hesterberg, pres. Brooklyn Boro, Boro Hall, 4 portable air compressors, on trailers and 12 concrete breakers for Bureau Hys.

Commercial Buildings

RESIDENTIAL

BIDS ASKED

Calif., Oakland—See "Contracts Awarded."

Calif., San Francisco — See "Contracts Awarded."

N. J., Jersey City — See "Contracts Awarded."

N. J., Newark—See "Contracts Awarded."

N. J., North Bergen—B. Scherb, 295 Central Ave., taking bids on seperate contracts 3 story, basement, brick, steel, 4th Ave. $150,000. M. Kraut, 3010 Hudson Blvd., Jersey City, archt.

N. Y., Arverne—A. Horowitz, 238 Beach 75th Street, soon takes bids general and separate contracts 6 story., Grassmere Terrace and Beach 25th St. $500,000. I. Goldstein, c/o owner, archt.

N. Y., Bayside—See "Contracts Awarded."

N. Y., Forest Hills—See "Contracts Awarded."

N. Y., Long Island City — See "Contracts Awarded."

N. Y., New York—See "Contracts Awarded."

N. Y., St. Albans—See "Contracts Awarded."

N. Y., St. George—Rosjen Land Co., c/o Cohn Bros., archts., 215 Montague St., Brooklyn, bids after June 1 on separate contracts, 6 story, 98 x 150 ft., Hart Blvd. and Forest Ave. $150,000.

N. Y., Yonkers—Bronx Road Associates, 40 East 49th St., New York, soon takes bids general and separate contracts 6 story, Bronxville Rd. near Palmer Ave. $600,000. Private plans.

N. Y., Woodside—See "Contracts Awarded."

Pa., Pittsburgh—Owner, c/o D. A. Crone, archt., 212 Oliver Ave., taking bids 3 story, basement, 90 x 150 ft., brick, steel, Oakland Dist. $150,000-$200,000.

T. H., Honolulu — C. W. Dickey, archt., Damon Bldg., taking bids rein.-con. hotel, for Halekulani Hotel. $175,000.

CONTRACTS AWARDED

Calif., Oakland—H. A. Schuster, 2424 Curtis St., Berkeley, 6 story, basement, rein.-con., day labor. $300,000. W. Lowe, 354 Hobart St., archt.

Calif., San Francisco—I. Epp, 4745 Geary St., 6 story, basement, rein.-con., steel, Walnut and Clay Sts., day labor. $150,000.

Calif., San Francisco—Reibman & Epp, 4745 Geary St., 7 story, basement, steel, concrete, Grove and Fillmore Sts. $200,000. Owner builds.

Calif., San Francisco—Sheldrake Hotel Co., c/o H. C. Baumann, archt, 251 Kearny St., 16 story, basement, steel, concrete hotel, Pine St. near Powell St., to Monson Bros., 475 6th St., $250,000.

N. J., Jersey City — P. Gott, 1134 Hudson Blvd., Bayonne, 3 story, basement, brick, steel, 21-25 Stegman Pl., separate contracts, $150,000. B. Singer, 921 Bergen Ave., archt.

N. J., Newark—Warranty Investment Co., 53 Chancellor Ave., 3 story, basement, brick, steel, 203 Shepherd Ave., separate contracts. $150,000, S. Cohen, 134 Branford Pl., archt.

N. Y., Bayside—Moss Bayside Homes, 163-98 Jamaica Ave., Jamaica, apartment, Metropolitan Parkway, separate contracts. $250,000. D. J. Levinson, 163-18 Jamaica Ave., Jamaica, archt.

N. Y., Forest Hills—Kew Forest Constr. Co., 6849 Ingram St., apartment, Ingram St. and Herrick Aves, separate contracts. $300,000. Private plans.

N. Y., Long Island City—Fieldwood Realty Co., 41-28 Queens Blvd., 4 story, basement, 43rd St. and Queens Blvd., separate contracts. $200,000. C. Stidolph, 8701 51st Ave., archt.

N. Y., Long Island City—Pajel Realty Co., 5903 15th Ave., Brooklyn, 6 story, 70 x 117 ft., Newtown Ave. and 27th St., separate contracts. $200,000. Cohn Bros., 363 Stone Ave., Brooklyn, archts.

N. Y., Long Island City—Morris Corp., Chatham Phoenix Bldg., Jamaica, 6 story, 41st St. and 43rd Ave., separate contracts. $200,000. B. Braunstein, 163-18 Jamaica Ave., Jamaica, archt.

N. Y., New York—Corporation, c/o P. Gould, 1910 Arthur Ave., 6 story, 60 x 150 ft., Monterey Ave. and 178th St., separate contracts. $265,000. G. W. Swiller, 4215 3rd Ave., Archt.

N. Y., New York — Corporation, c/o J. Strenger, 3034 White Plains Ave., 6 story, 90 x 100 ft., Mace and Barnes Ave., separate contracts. $175,000. Franklin, Bates & Heindsmann, 2526 Webster Ave., archts.

N. Y., New York—De Pia Ni Realty Corp., A. Piazza, pres., 585 West 204th St., 108 West 227th St., separate contracts. $350,000. Hillberg & LaVelle, 41 East 42nd St., archt.

N. Y., New York—Henry Mandel Corp., 10 East 40th St., 19 story, 7th Ave. from 19th to 20th Sts., separate contracts. $4,000,000. Farrar & Watmough, 10 East 40th St., archts. Bids about June 1 for excavation, found., steel, etc.

N. Y., New York—Improved Realty Corp., 521 5th Ave., 6 story, 86 x 135 ft., Putnam Pl. near Gun Hill Rd., separate contracts. $150,000. Boak & Parks, 10 East 40th St., archts.

N. Y., New York—P. Krumholz, 2910 Wallace Ave., 6 story, Fordham Rd. near Cedar

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Residential (Continued)

Ave., separate contracts. $275,000. Becker & Levy, 349 East 149th St., archts.

N. Y., New York—S. Minskoff, 521 5th Ave., 6 story, 84 x 99 ft., Kings College Pl. near Gun Hill Road, separate contracts. $155,000. Boak & Parks, 10 East 40th St., archts.

N. Y., New York—J. M. Petrone & Petro Constr. Corp., 1068 Waring Ave., 6 story, 64 x 130 ft., Waring and Barker Aves., separate contracts. $160,000. M. W. Del Gaudio, 545 5th Ave., archt.

N. Y., St. Albans—St. Albans Lawns, Inc., 6849 Ingram St., Forest Hills, apartment, 227th St. and Foch Blvd., separate contracts. $210,000.

N. Y., Woodside—Queens Homes, Inc., Woodside Blvd. and 67th Rd., apartment, Seward Ave. and 234th St., separate contracts. $150,000. Private plans.

N. Y., Woodside—Apex Homes, 3740 82nd St., Jackson Heights, apartment, 64th St. and Hicks Dr. separate contracts. $155,000. M. Rothstein, 186 Joralemon St., Brooklyn, archt.

O., Lakewood—Oscar & Einstein, 801 Parkwood Dr., Cleveland, masonry contract 4 story, basement, 60 x 96 ft., brick, to S. Grafchik, 3418 East 142nd St., Cleveland. Total est. $150,000.

Wash., Yakima—Naches Hotel Co., 15 story, 130 x 150 ft. hotel, to H. S. Wright Co., 2210 2nd Ave., Seattle. Est. $800,000. Noted Nov. 6.

CLUBS

PROPOSED WORK

N. J., Hohokus — Owner, c/o P. J. Jossier, archt., 240 Broad Ave., Palisades Park, will not build 2 story, basement golf club. $200,000. Project abandoned. Noted Jan. 1.

Tex., San Antonio—Longhorn Athletic Club, c/o E. H. Kifer, pres., c/o Architects office, plans by A. B. and R. M. Ayres, Smith-Young Tower, 14 story, basement athletic club building, incl. stores, club rooms, bowling alleys, gymnasium, track, swimming pool, hand and basket ball, locker room with complete steel equipment, etc., merchandising mart on upper 6 floors, Villita St. $1,000,000. W. Simpson, Milam Bldg., engr.

BIDS ASKED

N. J., New Brunswick — Cherry & Matz, archts., 441 Lexington Ave., New York, taking bids general contract 3 story, basement, brick, steel fraternity house, for Beta Theta Pi, c/o Rutgers University. $150,000.

CONTRACTS AWARDED

Ill., Kewanee—Kewanee Y.M.C.A., W. E. Lauterbach, secy., 1025 South Main St., general contract 2 story, basement, 114 x 120 ft., rein.-con., brick club, plain found., 1st St., to T. S. Willis, Janesville; plumbing, heating and ventilating, to Dooley Bros., Kewanee; electric wiring, to Kewanee Electric & Radio Shop, Kewanee. Est. $200,000.

HOSPITALS

PROPOSED WORK

Calif., Santa Rosa—Bd. Comrs. Sonoma Co. sketches (1st unit) hospital. $100,000. Total exceed $150,000. Architect not selected.

Mass., Roxbury (sta. Boston) — House of Good Samaritan, A. Cunningham, pres., 100 Arlington St., soon lets contract 2 story, basement, brick, limestone, granite hospital wing, plain found., Binney St. $150,000. Andrews, Jones, Biscoe & Whitmore, 50 Congress St., Boston, archts. Noted Nov. 20.

Mo., Jefferson City—St. Mary's Hospital soon takes bids 4 story, rein.-con. brick, hospital addition. O'Meara & Hills, 1036 Arcade Bldg., St. Louis, archts.

T. H., Honolulu—Queen's Hospital plans by C. W. Dickey, Damon Bldg., 2 story, basement nurses home. To exceed $150,000.

BIDS ASKED

Miss., Whitfield—May 5, by State Hospital Removal, Impvt. & Land Sale Comn., Jackson, 8 new buildings, incl. hospital, dining hall, and cottages. N. W. Overstreet, Jackson, archt.

Mass., Worcester—May 8, by Worcester Co. Comn., E. W. Glidden, Court House, 3 story, 40 x 420 ft. hospital, 2 story, 42 x 130 ft. nurses' home, 2 story, 85 x 85 ft. service building, 1 story, 80 x 85 ft. power plant, all brick, stone, steel, also water system series of wells, acreage lies in Boylston, Worcester and West Boylston. $1,000,000. Frost, Chamberlain & Edwards, 390 Main St., archt. Noted Apr. 9.

N. J., Newark—Bd. City Comrs., City Hall, bids about May 15, general contract 2 story, basement, 30 x 110 ft., brick, steel ward and recreation wing, Ivy Hill Almshouse. $200,000. J. T. Simpson, 45 Walnut St., archt. Noted Apr. 9 Daily.

N. Y., Brooklyn—Dpt. Hospitals, Municipal Bldg., New York, bids about June 1 or later, psychopathic building addition, Kings County Hospital. $150,000. C. B. Meyers, 31 Union Sq., New York, archt. Noted Jan. 1.

N. J., Clinton—May 1, by Dpt. Institutions & Agencies, Trenton, 3 story, basement, 50 x 120 ft. hospital at New Jersey Reformatory for Women. $150,000. Division of Architecture & Constr., State Office Bldg., Trenton, archts.

O., Cleveland — May 1, by City, D. R. Morgan, mgr., 6 story, basement, 130 x 213 ft., brick, steel tuberculosis sanitarium, Scranton Rd. $950,000. H. Kregelius, 504 City Hall, archt. Noted Dec. 4.

CONTRACTS AWARDED

Ark., Little Rock—State, (2nd unit) Farm Colony of State Hospital for Nervous Diseases, to W. Peterson, Donaghey Bldg., $304,500.

Mass., Mattapan (sta. Boston) — City of Boston, Hospital Dpt., 1 story, brick recreation building, to John Bowen Co., Inc., 129 Newbury St., Boston, $45,900. Noted Mar. 19.

Mass., Roxbury (sta. Boston) — Kendall, Taylor & Co., archts., 209 Columbus Ave., Boston, 1 and 4 story, basement, irregular sized, brick, steel, stone hospital addition, plain found., Parker Hill Ave., to Mozzicato & DiPietro, 12 Hancock St., Boston, for New England Baptist Hospital Corp., 85 Parker Hill Ave., Boston. Est. $200,000. Noted Feb. 26.

N. Y., New York—Dpt. Hospitals, Municipal Bldg., general contract altering, constructing addition to Lincoln Hospital, to D. M. W. Contg. Co., Jerome Ave. and 195th St., $874,000; plumbing, to Lossock Gaynor Corp., 119 Prospect St., Long Island City, $143,000; heating, to J. H. Martin, Inc., 254 West 31st St., $139,441. Grand total $1,156,441. Noted Mar. 5.

N. Y., New York—Dpt. Hospitals, J. G. W. Greeff, comr. Municipal Bldg., general contract nurses' home addition, at Riverside Hospital, North Brother Island, to Mercury Constr. Co., 7 East 42nd St., $84,368; plumbing, to Davmor Plumbing & Heating Co., 33-11 28th Ave., Long Island City, $8,481; heating, to H. Sand & Co., Inc., 158 Greene St., $5,695. Grand total $98,544. Noted Feb. 19.

CHURCHES

PROPOSED WORK

Calif., Los Angeles—Roger Williams Baptist Church, 29th St. and Orchard Ave., H. C. Mathews, pastor, sketches Class A Church. $200,000. Architect not selected.

N. J., Irvington (br. Newark) — Methodist Episcopal Church, R. L. Luerich, pastor, 64 Myrtle Ave., will not build 2 story, basement church. $200,000. Project abandoned. Noted Mar. 26.

N. J., Maplewood — H. B. Upjohn, archt., Grand Central Terminal, New York, bids after Apr. 27, general contract 2 story, basement, brick, steel, for Wyoming Presbyterian Church, S. P. Shackleton, 430 Wyoming Ave. $150,000. Noted Mar. 12.

N. J., Union — Congregation Presbyterian Church, c/o F. A. Elsasser, archt., 1000 Stuyvesant Ave., Union, will not alter and construct 3 story chapel addition. Project abandoned. Noted Jan. 22.

BIDS ASKED

N. J., Keansburg—V. J. Eck, archt., 155 Broad St., Red Bank, taking bids 2 story, brick, steel convent, plain found., for St. Annes Roman Catholic Church. $150,000.

CONTRACTS AWARDED

N. J., East Orange—A. Humble, archt., 6 East 45th St., New York, general contract altering and constructing 2 story, basement, brick, steel addition, Prospect and Norman Sts., to R. McLeod, Inc., 255 Main St., for Central Church of Bloomfield and East Orange, Prospect St. $150,000. Noted Feb. 18.

SCHOOLS

PROPOSED WORK

Ill., Niles Center—Bd. Educ. School Dist. 73½, soon takes bids (1st unit) Cleveland School, 1 story, incl. kindergarten, gymnasium, auditorium Cleveland St. and Kildare Ave. $85,000. Total $200,000. F. V. Prather, 400 North Michigan Ave., Chicago, archt.

Ind., Brookston — School Comrs., plans by W. G. Rammel, Logansport, brick, rein.-con., stone school. $150,000.

Ind., Buckskin—School Comrs. plans by Sutton & Routt, Citizens Trust Bldg., Vincennes, brick, steel grade school. $150,000.

Ind., Laporte—School Comrs. plans by G. W. Allen, Laporte Bank Bldg., 2 story, basement, 78 x 217 ft., rein.-con., brick high school. $150,000.

Ind., Mackey—School Comrs. plans by Sutton & Routt, Citizens Trust Bldg., Vincennes, 2 story basement, rein.-con., brick, stone grade and high school, incl. auditorium, gymnasium, $150,000.

Ind., Munster—School Comrs. plans by M. Turner, 410 State St., Hammond, brick, steel, stone school. $150,000.

Ind., Sommerville—Bd. School Comrs. plans by Sutton & Routt, Citizens Trust Bldg., Vincennes, brick, steel school. $150,000.

Ind., South Bend—School Comrs. plans by E. W. Young, 807 Sherland Bldg., brick, steel gymnasium, 4,500 seating capacity, at Athletic Field, South Eddy St. $175,000.

Ind., Staunton—School Comrs. sketches high school. $150,000. Architect not selected.

Me., Charleston—Higgins Classical Institute, E. E. Herrick, pres. Bd. Trustees, plans by Crowell & Lancaster, 6 State St., Bangor, and soon takes bids brick, school buildings. To exceed $150,000. Noted Feb. 5.

Me., Waterville—St. Francis DeSales Parish, D. J. Martin, plans by W. E. Provost, 1061 Elm St., Manchester, N. H., 3 story, basement, brick, steel convent. $350,000.

Mass., Lawrence—City, M. A. Landers, mayor, brick, steel school addition, Haverhill and Lawrence Sts. $150,000. **Maturity in fall.** Architect not selected.

N. H., Durham — University of New Hampshire, E. M. Lewis, soon takes bids 2 story, basement, brick, steel infirmary, rest house, plain found. $150,000. E. T. Huddleston, Durham, archt. Kilham, Hopkins & Greeley, 9 Park St., Boston, Mass., consult. archts. Noted Dec. 4.

New Jersey—Bd. Educ., Wall Twp., sketches by W. H. Conover, 114 Liberty St., New York, four 1 story, brick, steel schools, plain founds., Wall Twp., Monmouth Co. $150,000. **Maturity in May.**

N. J., Jersey City — Sacred Heart Roman Catholic Church, M. J. Ripple, pastor, Bayview and Jackson Ave., sketches by Guilbert & Betelle, 20 Branford Pl., Newark, 4 story, basement, brick, steel convent, rectory, social center, education building, Bayview and Bidwell Aves. $500,000. Noted Nov. 6.

N. J., Newark—Bd. Educ., City Hall, bids in June, general contract Junior-Senior High School, 3 story, basement, brick, steel, rein.-con., Chancellor Ave. $1,000,000. Guilbert & Betelle, 20 Branford Pl., Newark, archts. Noted Apr. 16.

N. J., Piscataway—Bd. Educ., Raritan Twp., revised sketches by A. Merchant, 1 Elm Row, New Brunswick, Piscatawaytown School, 2 story, basement, brick, steel. $150,000. Noted Feb. 26.

N. J., Sayreville—Bd. Educ., Boro Hall, will not build 2 story, school. $150,000. Project abandoned. Noted Dec. 8 Daily.

N. J., Sussex — Bd. Educ., J. E. Stickney, clk., sketches by Jacoby & Everett, Allentown, Pa., 2 story, basement, brick, steel high school, plain found. $150,000. Noted Feb. 5.

N. J., Teaneck (br. Hackensack)—Bd. Educ., High School, will not build school, Garrison Ave. Project abandoned. Noted Mar. 26.

N. Y., Brooklyn—Bd. Educ., 500 Park Ave., New York, addition to Manual Training High School, 4th Ave. and 3rd St. $1,500,000. **Maturity indefinite.**

N. Y., New Brighton—Bd. Educ., 500 Park Ave., bids in May, general contract P. S. 49, Crescent Ave. $415,000. W. C. Martin, Flatbush Ave. and Concord St., Brooklyn, archt. Noted Jan. 12.

N. Y., New York—Bd. Educ., 500 Park Ave., needle trades continuation school, West 30th St. between 6th and 7th Sts. $2,100,000. **Maturity about July 1.**

Pa., Hanover (br. Wilkes-Barre)—Bd. Educ., c/o Secretary, soon takes bids 2 story, basement high school, incl. auditorium, gymnasium, Downing St. and Main Rd., Hanover Green. $150,000. H. G. Cook, Wilkes-Barre, archt.

R. I., Providence—City, P. Buildings Dpt., City Hall, plans by T. J. Hill Pierce, City Hall, brick, concrete school, incl. 2 gymnasiums, auditorium, library, Windmill and Paul Sts. $900,000.

Ont., Chatham—Bd. Educ., Harrison Hall, sketches by G. R. Gouinlock, 371 Bay St., Toronto, 3 story, basement, brick, steel concrete stone new collegiate institute or addition to vocational school, plain found. $200,000.

T. H., Honolulu—St. Andrew's Parish School plans by C. W. Dickey, Damon Bldg., school. $150,000.

BIDS ASKED

Calif., Albany—May 8, by Bd. Trustees Albany School Dist., 2 concrete school additions. $150,000. P. D. Dragon, 222 Kearny St., San Francisco, archt.

Me., Farmington—Town, School Dpt., sketches by Coombs & Harriman, 11 Lisbon St., Lewiston, 2 story, basement, brick, Quebec St. $150,000. Noted Nov. 13.

Mass., Cambridge — Apr. 28, by Parish of Our Lady of Pity (Roman Catholic), A. Millet, pastor, 35 Middlesex St., and J. G. Morissette, archt., 575 Essex St., Lawrence, 2 story, basement, 85 x 145 ft., brick, stone, steel, school, plain found., Sargent and Notre Dame Sts., $200,000; also 3 story, basement, irregular sized, brick, stone, steel convent, plain found., Notre Dame St., $150,000, both in North Cambridge. Noted Jan. 29 and Apr. 2.

N. H., Rochester—Apr. 28, by City, L. McDuffee, mayor, City Hall and W. S. Holmes Co., archts., 18 Newbury St., Boston, 2 story, basement, brick, stone school, plain found., Maple St. $150,000. Noted Apr. 9.

N. J., Jamesburg—Bd. Educ. bids about June 1, 2 story, basement, 85 x 185 ft., brick, steel high school, incl. gymnasium, auditorium, manual training and domestic science rooms. $150,000. J. N. Pierson & Son, 198 Jefferson St., Perth Amboy, archts. Noted Apr. 9.

N. J., New Brunswick—Bd. Educ., Livingston Ave., bids about May 15, 2 story, basement, brick, steel, addition to Senior High School, Livingston Ave. $250,000. A. Merchant, 1 Elm Row, archt. Noted Apr. 9.

N. J., Oakhurst — Bd. Educ., Ocean Twp., bids about May 15, general contract altering and constructing 2 story, basement, brick, steel addition. $150,000. W. Pieper, 95 Summit Ave., Summit, archt. Noted Apr. 2.

N. J., Peapack—Bd. Educ., Peapack-Gladstone Boro, Main St., bids about June 1, 2 story, basement, brick, steel addition. $150,000. A. Merchant, 1 Elm Row, New Brunswick, archt. Noted Apr. 9.

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Schools (Continued)

N. J., Union City—Bd. Educ., 415 32nd St., bids about July 1, general contract 3 story, basement, brick, steel, West St. between 5th and 6th Sts. $750,000. J. D. Lugosch, 714 Bergenline Ave., archt. Noted Apr. 9.

N. Y., Buffalo—Apr. 28, by Bd. Educ., 902 Genesee Bldg., altering Grover Cleveland High School, Normal, 14th and Jersey Sts., $135,000, equipment $89,000. School Architecture, 1413 Genesee Bldg., archt.

CONTRACTS AWARDED

Conn., New Britain—City, J. M. Halloran, chn. Building Com., 2 story, basement school, to M. Connor, 15 Standish St., Hartford, $145,909.

La., New Orleans—Louisiana State University, Baton Rouge, general contract 7 story, 54 x 200 ft., rein.-con., brick, limestone medical building, to R. P. Farnsworth & Co., Inc., Maritime Bldg., $556,521; plumbing, heating and ventilating, to Sciambra & Masino, Inc., 636 North Broad St., $127,932; electric equipment, to Hart Enterprise Electric Co., Inc., 826 Baronne St., $51,500; elevators, to Otis Elevator Co., 852 Carondelet St., $71,836. Grand total $807,789.

N. Y., Batavia—Div. Standards & Purchase, Albany, general contract dormitory at New York State School for Blind, to L. C. Whitford, Wellsville, $147,985; heating, to J. E. Reid, Buffalo, $8,220; sanitary work, to C. C. Grimm, Buffalo, $13,932; electrical work to Clifford Electric Inc. Buffalo, $5,025. Grand total $175,162. Noted Apr. 2.

N. Y. Buffalo—Bd. Educ., general contract School 83, 2 story, 103 x 185 ft., to B. Rebescher & Son, 110 Limon St., $108,991; heating and ventilating, to L. N. Castin, 1212 Michigan St., $28,832. Plumbing, to H. M. Dechert, 128 Erie St., $6,947; electrical work, to Lackawanna Electric Co., $9,100. Noted Sept. 11.

N. Y., Ithaca — Commissioner Dpt. Educ., State Educ. Bldg., Albany, founds. for Agricultural Economics, Marketing and Farm Management Building, Cornell University, to Peckham Constr. Co., Crosby Bldg., Buffalo, $34,883.

N. Y., Oswego — Commissioner Dpt. Educ., Education Bldg., general contract industrial arts building at State Normal School to Bedford Constr. Co., 1300 Broad St., Utica, $218,287; heating, to G. H. Hyde, Inc., River St., Watertown, $31,300; plumbing, to Howe & Bassett, 840 University Ave., Rochester, $12,431; electrical work, to Dwyer Electric Co., 213 Monroe Ave., Rochester, $19,207. Grand total $281,225. Noted Mar. 5.

THEATRES

PROPOSED WORK

Mass., Springfield—S. and N. Goldstein, 103 Bridge St., and Mowl & Rand, archts., 21 School St., Boston, soon lets contract 1 story, basement, brick, steel theatre, plain found., 167 State St. $150,000.

BIDS ASKED

Colo., Denver—Apr. 27, by Rapp & Rapp, archts., 190 North State St., Chicago, Ill., brick, steel theatre, 2,700 seating capacity, for R.K.O. Theatre, Inc., 190 North State St., Chicago. Foundation contract awarded to F. J. Kirchof Constr. Co., 700 Lawrence St.

N. J., Ocean City—Owner, c/o W. H. Lee, archt., 1505 Race St., Phila., Pa., taking bids 2 story, brick, steel, plain found. $150,000.

N. J., Pine Beach—Apr. 25, by Bd. Council, Boro Hall, grading, gravel surfacing 18,312 sq.yd. Station Ave., Riverside Dr. and Motor Rd. $25,000. H. C. Chinn, Municipal Bldg., Lakewood, engr.

OFFICES

PROPOSED WORK

D. C., Wash.—C. N. and N. Friz, archts., Lexington Bldg., Baltimore, Md., soon let contract 6 story, basement, 71 x 336 ft., rein.-con., brick steel, limestone, terra cotta office building, service station, B. 2nd and 3rd Sts. N. W., for Standard Oil Co. of New Jersey, 241 Pennsylvania Ave. N. W. $1,000,000. H. F. Doeleman, Baltimore Trust Bldg., Baltimore, Md., engr. Noted Jan. 29.

Ia., Sioux City—C. F. Lytle, 504 Nebraska St. soon lets contract razing present building, preparatory erecting 8 story, basement, 75 x 150 ft. terra cotta or stainless steel and aluminum office building, 5th and Pierce Sts. $750,000. K. E. Westerlind, Badgerow Bldg., archt. Noted Apr. 16.

N. J., Newark — F. A. Phelps, archt., 21 Fulton St., bids probably in May, general contract on revised plans 3 story, basement, brick, steel office, Washington Pl. and Halsey St.: for Eagle Fire Insurance Co., F. W. Fort, vice-pres. and genl. mgr., 18 Washington Pl. $150,000. Noted Mar. 12, under "Contracts Awarded."

BIDS ASKED

N. J., Fort Lee—May 18, at office General Manager Port New York Authority, 80-90 8th Ave., New York, 1 and 2 story, part basement, brick, steel, 86 x 194 ft. field office building, incl. garage, shop, for Hudson River Bridge between here and Fort Washinfton, N. Y.: adv. E. N.-R. Apr. 23.

N. J., Hackensack—F. Buono, 95 Main St., and P. J. Jossier, archt., 240 Broad Ave., Palisades Park, taking bids 2 story, basement, brick, steel office, store, Main St. $150,000.

Tex., Laredo—W. Epstein, 310 Crain St., San Antonio, and Laredo, taking bids (selected list of bidders), 10 story, basement, brick, rein.-con. office, store building, 80,000 sq.ft. floor space, 2 story, brick, rein.-con. garage building, plain founds. $500,000. W. H. Anderson & G. Trout, Laredo, archts. L. D. Royer, Smith-Young Tower Bldg., San Antonio, mechanical engr. Matthews & Kenan, Milam Bldg., San Antonio, engrs. Noted Apr. 2.

CONTRACTS AWARDED

N. J., Irvington (mail Newark) — W. E. Lehman, archt., 972 Broad St., Newark, general contract 2 story, basement, 80 x 160 ft., brick, steel office, store, to Fatzler Co., 11 Hill St., Newark, for U. S. Realty & Investment Co., 972 Broad St. Est. $150,000. Noted Jan. 29.

STORES

PROPOSED WORK

N. J., Newark — A. Radnevitz, 53 Chancellor Ave., revised plans by S. Cohen, 134 Branford Pl., 3 story, basement, brick, steel store, apartment, 322-28 Osborne Terrace. $150,000. Noted Feb. 19, under "Contracts Awarded."

N. J., Orange—C. Messina, 52 North Day St., will not build 3 story, basement, brick, steel store, apartment, 52 North Day St. $150,000. Project abandoned. Harris & Sohn, 17 Mechanic St., Newark, archts. Noted Mar. 19.

N. Y., Astoria—Goodrich Constr. Co., 2474 27th St., plans by M. Margolin, 215 Montague St., Brooklyn, 6 story, 122 x 172 ft. store apartment, 25th Ave. and West 29th St. $200,000.

BIDS ASKED

Mass., Quincy—E. J. Johnson, c/o Blackall, Clapp, & Whittemore & Clark, archts., 31 West St., Boston, taking bids 4 story, basement, 50 x 120 ft., brick, stone store, apartment, plain found., Hancock and Maple Sts. $150,000. Former contract rescinded. Noted Feb. 12, under "Contracts Awarded."

N. Y., Forest Hills—See "Contracts Awarded."

CONTRACTS AWARDED

N. Y., Jamaica—Gross Constr. Co., 160-16 Jamaica Ave., general contract 2 story, 110 x 193 ft. stores, to Caye Constr. Co., 356 Fulton St., Brooklyn. Est. $150,000. Noted Jan. 22.

N. Y., Jamaica — H. Levy, 113-18 Jamaica Ave., 4 story store, office, to P. J. Murphy, 9232 Union Hall Ave. Est. $150,000. Noted Apr. 9.

PUBLIC

PROPOSED WORK

Mass., Springfield — NATURAL HISTORY MUSEUM—City Library Assn., sketches by E. L. Tilton, 420 Lexington Ave., New York, natural history museum. $160,000.

Minn., St. Paul—AUDITORIUM—Apr. 28, by C. A. Carlson, city purch. agt., rein.-con., brick addition to municipal auditorium, remodeling present structure, 4th, 5th, Washington and Franklin Sts., for City, $1,100,000. C. A. Bassford, city archt. Ellerbe & Co., 525 Minnesota Bldg., assoc. archts.

N. J., Elizabeth — CITY HALL and MUNICIPAL — Bd. City Comrs., City Hall, bids probably in July, 10 story, basement, brick, steel, rein.-con. $1,000,000. Oakley & Son, 1259 Clinton Pl., archts.

N. J., Matawan — BORO HALL — Bd. Boro Council, Boro Hall, will not build 2 story, basement boro hall, $150,00. Project abandoned. Architect not selected. Noted Apr. 9.

N. Y., New York—HEALTH CENTER—Dpt. Health, 505 Pearl St., health center, dental and X-ray clinics, 176th St. and Arthur Ave. $150,000.

N. J., South Belmar—BORO HALL, etc.—Bd. Boro Council, Boro Hall, sketches 2 story, basement, brick, steel, boro hall, police headquarters, jail. $150,000. Noted Apr. 9.

N. J., Weehawken—LIBRARY—Township Comn., Municipal Bldg., will not build 2 story, basement, brick, steel library, Park and Hauxhurst Aves. $150,000. Project abandoned. Noted Apr. 9.

N. Y., Brooklyn—FIRE DEPARTMENT—Fire Dpt., Municipal Bldg., New York, fire department training school, testing field, jumping tower, repair shop, administration building. $2,000,000. **Maturity probably late in June.** H. J. Tracy, in charge.

BIDS ASKED

R. I., Providence—COURT HOUSE—State, Providence Co. Court House, W. B. Greenough, chn. com., 30 South Main St., bids about June 1, north wing, county court house. Total est. $2,300,000. Jackson, Robertson & Adams, Turks Head Bldg., archts. Noted Jan. 8.

CONTRACTS AWARDED

Wyo., Laramie—COURT HOUSE—Bd. Comrs. Albany Co., general contract 3 story, 63 x 142 ft. court house, to C. B. Jensen, 711 South 9th St. $125,000. Noted Apr. 2.

Que., Montreal—FIRE STATIONS—Montreal Corp., fire station, Montcalm Ward, to Frenette & Freres Ltd., 2123 Carriere St., $173,469; fire

UNCLASSIFIED

PROPOSED WORK

Conn., Mystic—ART—Mystic Art Assn. Inc., G. A. Thompson, soon lets contract 2 story, 45 x 65 ft. and 25 x 55 ft., brick, stone art buildings, $150,000. Jackson, Robertson & Adams, 1216 Turks Head Bldg., Providence, R. I., archts. Noted Apr. 2.

Md., Baltimore—AUDITORIUM—B. Evander, archt., 20 East Lexington St., rejected bids Mar. 26, altering, constructing brick, steel, concrete addition, 1207-15 North Charles St., for Tall Cedar Building Corp., c/o Architect. Est. $200,000. H. F. Doeleman, Baltimore Trust Bldg., engr. Noted Mar. 26.

Mass., Boston—PUBLISHING, etc.—Christian Science Publishing Society & Christian Science Monitor, c/o C. L. Churchill, archt., 9 Newbury St., 3 and 9 story, basement, 100 x 680 ft., rein.-con., steel, granite, limestone publishing and service plant building, Back Bay Sect. $3,000,000. Lockwood Greene Engineers, Inc., 24 Federal Sts., engrs.

N. J., Netcong—EXCHANGE—New Jersey Bell Telephone Co., 540 Broad St., will not build 1 story, basement, brick, steel exchange, $150,000. Project abandoned. H. B. Brady, Inc., 333 North Broad St., Elizabeth, archt. Noted Apr. 2.

Que., Montreal—CONVALESCENT HOME—Montreal Convalescent Home, O. J. Callary, chn., plans new building, St. Mark St. $300,000.

Calif., Culver City — STAGE and STUDIO SCENE DOCK—R. K. O. Pathe Studios taking bids 150 x 315 ft. frame, stucco stage buildings: 120 x 225 ft. frame, stucco studio scene dock.

N. J., Hopewell—ORPHANAGE—Apr. 27, by E. G. Perrot, archt., 1211 Arch St., Phila., Pa., 3 story, brick addition, plain found., for St. Michaels Orphan Asylum, Hopewell. $150,000.

CONTRACTS AWARDED

N. J., East Orange — MEDICAL — Medical Building Corp., A. W. Bingham, pres., 219 Harrison St., general contract 8 story, 65 x 195 ft., brick, steel, rein.-con., to Robert Allen, Inc., 319 Mount Pleasant Ave., Newark. Est. $400,000. Noted Apr. 16.

Industrial Buildings

FACTORIES AND MILLS

PROPOSED WORK

Calif., Los Angeles—REFINING PLANT—International Sugar Co., 637 Battery St., San Francisco, sketches fireproof refining plant. $2,000,000.

Ill., Pekin—CORN SUGAR PLANT—Corn Products Refining Co., 17 Battery Pl., New York, postponed taking bids corn sugar plant. Est. $1,000,000. Project indefinitely in abeyance. Noted Jan. 15.

Mass., Boston—PUBLISHING—Boston News Bureau, H. Bancroft, pres., 32 Kilby St., altering publishing building, 18-20 Central St. $40,000 or more. Architect not selected.

Mo., Caruthersville—BUTANE GAS FACTORY—W. A. Howard and S. J. Campbell, Kansas City, granted franchise plant for vaporization of butane gas, and distribution mains.

N. J., Newark—FACTORY—W. E. Lehman, archt., 972 Broad St., soon lets general contract 2 story, basement, 98 x 130 ft., brick, steel, factory, office, Frelinghuysen Ave. and Noble St., for Oliver Relish Co., 115 South St. Est. $40,000.

N. J., Newark—FACTORY—Unique Art Mfg. Co., 196 Waverly Ave., plans by S. Saul & Co., 24 Commerce St., 2 story, basement, brick, steel, Waverly Ave. $100,000. Noted Feb. 19.

N. J., Seabright—FISH PACKING PLANT and GARAGE—Bd. Comrs., City Hall, 1 story, basement, brick, steel, concrete. Public Beach. $40,000. **Maturity probably soon.**

N. Y., Long Island City—FACTORY—General Bronze Corp., M. Daniels, in charge, plant, $500,000-$1,000,000. Project in abeyance. Noted Jan. 15.

O., Alliance — FACTORY — Machine Steel Castings Co., W. E. Trump, genl. mgr., soon takes bids 1 story, 40 x 100 ft. storage building, 25 x 30 ft. core room addition, installing conveyor system, new moulding machines. $55,000. Private plans.

O., Barnesville—FACTORY—Lotus Glass Co. 1 story, 30 x 60 ft., brick, steel. $40,000.

O., Cleveland—FACTORY—Amer. Multigraph Co., H. C. Osborn, pres., 1814 East 40th St., brick factory. $50,000. Architect and site not selected.

O., Warren — FACTORY — United States Gypsum & Lime Co., 111 West Washington St., Chicago, Ill., 1 story, steel, concrete, brick, 50,000 sq.ft. floor space, Phoenix•Rd. $100,000.

Tex., Corpus Christi—COMPRESSOR PLANT—Aransas Compress Co., plans by Hardy & Curran, c/o Nixon Bldg., Unit 3, brick, concrete, steel addition, 36,400 sq.ft. floor space. $75,000.

Tex., Crystal City—ICE PLANT—Shippers Co-operative Co., J. L. Price, pres., soon takes bids 1 story, 150 ton capacity, rein.-con., brick, steel, plain found. $150,000. Private plans.

Tex., El Paso — ROD MILL and COPPER WIRE FACTORY — Nichols Copper Co., 25 Broad St., New York, c/o J. P. Dwyer, P. O. Box 1372, brick, rein.-con., plain found. $1,500,000.

Ont., Hamilton — PACKING PLANT — John Duff & Sons Ltd., Brant St., soon lets contract 2 story, basement, 75 x 150 ft., rein.-con., Hillyard St. $100,000. Stewart McPhie, Sun Life Bldg., archts. Noted Sept. 13.

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Factories and Mills (Continued)

Sask., Saskatoon — ABATTOIR, etc. — Saskatchewan Live Stock Pool, abattoir and processing plant. $70,000.

Sask., Saskatoon—DAIRY—Saskatoon Dairy Poll, creamery plant, 1st Ave. $50,000.

BIDS ASKED

Ind., Gary—PLANT—See "Contracts Awarded."

N. J., Garfield — LAUNDRY PLANT — F. Sciortino & V. Lamendola, Main St., bids about May 15, general contract 1 story, basement, brick, concrete, steel, Division Ave. $40,000. A. L. Vigliante, 40 Passaic St., archt. Noted Apr. 9.

Mass., Peabody — LEATHER FACTORY — Carr Leather Co., 111 Foster St., taking bids 5 story, 45 x 100 ft., brick, timber, Foster St. To exceed $40,000. Private plans.

O., Cleveland—PACKING PLANT—Cleveland Provision Co., H. A. Schanz, pres.-treas., 2527 Canal Rd., taking bids 2 story, basement, brick, steel, concrete, 3378 West 65th St. $250,000. P. Henchein, 59 East Van Buren St., Chicago, Ill., engr. Noted Dec. 11.

Tex., Rio Grande City—ICE PLANT—Central Power & Light Co., Natl. Bank of Commerce Bldg., San Antonio, bids about Apr. 24, 1 story, 40 x 70 ft., brick, steel, rein.-con., 75 ton capacity plain found. $90,000. J. Marriott, Natl. Bank of Commerce Bldg., San Antonio, archt. Noted Mar. 5.

CONTRACTS AWARDED

Calif., Watsonville—ICE MANUFACTURING PLANT—Union Ice Co., 354 Pine St., San Francisco, 1 story, rein.-con., to W. W. Williamson, 320 Market St., San Francisco, $100,000.

Ill., Chicago—MANUFACTURING PLANT—Lockwood, Greene & Co., engrs., 400 North Michigan Ave., manufacturing plant addition, to Consolidated Eng. Co., 20 East Franklin St., Baltimore, Md., for E. Katzinger Co., 1959 North Cicero Ave. Est. $60,000.

Ind., Gary—PLANT—Amer. Sheet & Tinplate Co., brick, steel addition, own forces. $50,000. Private plans.

Ia., Sioux City—DAIRY PLANT—G. B. Hilgers, United Bank Bldg., general contract 2 story, basement, 160 x 175 ft., concrete, rein.-con., brick, plain found., to H. Holtze, 2121 East 4th St., $75,000. Noted Feb. 19.

Ia., Waterloo — ICE MANUFACTURING PLANT—Crystal Ice & Fuel Co., 129 East Mullen Ave., 1 story, 80 x 120 ft., concrete, brick, tile, to H. A. Maine Constr. Co., 305 Marsh Pl. Bldg.; installing machinery, to Vilter Mfg. Co., 2217 South 1st St., Milwaukee, Wis. Est. $75,000.

La., Baton Rouge — CREAMERY — Weiss, Dreyfus & Seifer, archts., Maison Blanche Bldg., general contract 2 story, rein.-con., brick, tile, for Louisiana Creamery Co., Inc., to A. C. Stewart, Baton Rouge, $81,900. Noted Mar. 26.

Md., Baltimore—FACTORY—Campbell Metal Window Co., Bush and Hamburg Sts., 2 story, 80 x 100 ft., and 1 story, 24 x 200 ft., brick, Bush and Hamburg Sts., to Davis Contg. Co., 9 West Chase St.

Mass., Everett—PLANT—Merrimac Chemical Co., J. B. Rudder, in charge, 2 story, 60 x 150 ft., brick, concrete, steel glauber building, plant unit, plain found., to A. C. Peters Co., Inc., 46 Cornhill, Boston. Est. $65,000. Noted Apr. 9.

Mass., Hyannis—LAUNDRY—Owner, c/o E. B. Stratton, archt., 113 State St., Boston, 1 story, 45 x 115 ft., brick, rein.-con., steel auto laundry, concrete found., Sea St., to C. C. Temple Co., 99 Chauncy St., Boston. Est. $40,000.

N. J., Newark—MILL—Art Metal Wks., L. V. Aaronson, pres., 7 Mulberry St., general contract altering Mill 1, 4 story, constructing 2 story top addition to Mill 13, 9-29 Mulberry St., to H. M. Doremus & Co., 79 Orange St., Newark. Est. $40,000.

O., Cleveland — FACTORY, etc. — Cleveland Ice Cream Co., D. H. Schlegal, pres., West 47th St. and Train Ave., 1 story, brick, steel, concrete factory, garage, West 47th St., to Wm. Dunbar Co., 8201 Cedar Ave. Est. $40,000.

O., Cleveland—FACTORY—W. M. Hardie Co., W. M. Hardie, pres., 2260 East 69th St., 6 story, basement, 60 x 115 ft., brick, steel, to Sam W. Emerson Co., 1836 Euclid Ave. Est. $200,000. Noted Apr. 9.

Pa., Conshohocken—FACTORY—Reilly Whitman Walton Co., Canal Bank Bldg., 1 and 2 story, 122 x 144 ft., irregular sized, brick, steel, plain found., to E. Reeves, 107 York Rd., Abington.

Pa., Phila.—MANUFACTURING—Barrett & Co., 40 Rector St., New York, 1 story, 50 x 141 ft., 1 story, 48 x 141 ft., 3 story, 58 x 87 ft., 3 story, 57 x 115 ft., and 3 story, 46 x 115 ft., steel, brick coal tar products manufacturing plant, plain found., to Turner Constr. Co., Architects Bldg. Est. $150,000.

Pa., Uniontown—SHIRT FACTORY—H. W. Altman, archt., 306 Fayette T. & T. Bldg., general contract 2 story, 75 x 240 ft., to Fairchance Lumber Co., Fairchance, for Industrial Corp. of Uniontown, W. Miller, pres. $46,245.

Tex., Texas City — REFINERY PLANTS — Republic Oil Refining Co., oil refinery, incl. cracking unit. $500,000. Owner builds. Private plans.

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Wis., Appleton—CHEMISTRY—Institute of Paper Chemistry, general contract 2 story, basement, 50 x 114 ft., limestone chemistry building, to B. B. Ganther Co., Oshkosh. Est. $100,000.

GARAGES

PROPOSED WORK

Calif., San Francisco—Macdonald & Kahn, Financial Center Bldg., postponed building garage, Folsom and Main Sts. $300,000. U. S. Post Office Dpt., lessee. Noted Dec. 11.

Mass., Melrose—Eastern Massachusetts Street Ry. Co., 38 Chauncy St., Boston, 1 story, brick, steel, concrete bus garage, Green St. $50,000 or more. Private plans.

Minn., St. Paul—First Natl. Bank, E. A. Taylor, dir. constr. 602 Merchants Natl. Bank Bldg., soon lets contract 8 story, basement, 100 x 130 ft., brick, steel garage, 4th and Minnesota Sts. $350,000. Ellerbe & Co., 525 Minnesota Bldg., archt.

N. J., Hasbrouck Heights—A. Cornith, c/o Aitken Bros., 270 Terrace Ave., garage, on 500 x 627 ft. site, Terrace Ave. $150,000. **Maturity probably soon.**

N. J., Jersey City—Owner, c/o C. Shilowitz, archt., 26 Journal Sq., 15 story, basement, brick, steel garage. $500,000. **Maturity soon.**

N. Y., Brooklyn—T. L. E. G. Constr. Corp., c/o M. Goodman, pres., 65 Court St., soon takes bids general and separate contracts, 1 story, 98 x 100 ft. service garage, gas station, Oakland and Box Sts. To exceed $40,000. M. Klein, 65 Court St., archt.

N. Y., New York—Thirty West End Corp., N. Wallenstein, pres., 33 West 42nd St., sketches by W. Shary, 22 East 17th St., 4 story, 99 x 100 ft., storage garage, 28 West End Ave. $150,000.

N. Y., New York—Navone Bros., 17 LeRoy St., sketches by M. W. Del Gaudio, 545 5th Ave., story, 50 x 180 ft. garage, office, 18 Morton St. $150,000.

Utah, Salt Lake City—L. Berretts & Mrs. A. Mayers, c/o Halloran Judge Trust Co., 301 South Main St., sketches 115 x 165 ft. garage, $40,000. Architect not selected. City Motor Sales Co., 460 South State St., lessee.

BIDS ASKED

N. Y., Brooklyn—Atlantic & Classon Ave. Corp., A. Kaplan, pres., 26 Court St., taking bids general and separate contract 1 story, 100 x 100 ft. service garage, gas station, Atlantic and Classon Aves. $40,000. W. A. Lacerenza, 26 Court St., archt. Noted Apr. 2.

N. Y., Brooklyn—Casper Realty Co., 6117 4th Ave., taking bids general and separate contracts, 1 story, 100 x 100 ft. service garage, 4th Ave. and 63rd St. $40,000. D. S. Lang, 1860 Bway., New York, archt. Noted Apr. 16.

N. Y., New York—S. Cincelli, 2393 Arthur Ave., bids about May 15, general contract 1 story, 90 x 119 ft. service garage, Hoffman and 184th Sts. $40,000. M. W. Del Gaudio, 545 5th Ave., archt. Noted Apr. 9.

N. Y., New York—N. Rotholz, archt., 155 East 42nd St., New York, taking bids service garage, 174 Christopher St., for Barrow Street Corp., c/o D. O'Keefe, 347 Madison Ave. $275,000. Noted Apr. 9.

N. Y., New York—Webster Auto Wrecking Co. taking bids general contract 40 x 180 ft. garage and shop., Carter Ave. and 174th St. $40,000. I. Hohauser, 17 West 44th St., archt.

Pa., Phila.—See "Contracts Awarded."

CONTRACTS AWARDED

Pa., Phila.—S. H. Anderson, 1500 Walnut St., 1 story, 45 x 200 ft. garage and service station, G and Lycoming Sts., separate contracts. I. W. Levin, 1011 Chestnut Sts., archt.

SHOPS AND FOUNDRIES

PROPOSED WORK

Ind., Terra Haute—FOUNDRY—Terra Haute Malleable & Mfg. Co., sketches brick, steel foundry. $40,000. Private plans.

N. Y., Glendale—PLUMBING SHOP—Gorden Plumbing & Heating Supply Co., 77th Ave. and 77th St., altering plumbing supply storage and shop, 77th Ave. and 77th St. $40,000. Work will probably be done by separate contracts. A. Abrams, 102 Melrose Ave., Lynbrook, archt.

N. Y., Long Island City—SHOP, etc.—Dpt. Water Supply, Gas & Electricity, Municipal Bldg., New York, bids probably in May, 2 story, 58 x 150 ft. shop, office, Dryer and Packard Sts. $50,000. D. Campbell, 154 Amity St., Flushing, archt. Noted Apr. 9.

BIDS ASKED

Calif., Oakland — MACHINE SHOP — See "Contracts Awarded."

N. Y., Flushing—SHOP—A. Beaudel, Brookville and Conduit Blvds., bids after May 15, general and separate contracts 2 story, repair shop, Brookville and Conduit Blvds., $40,000. Private plans. Noted Mar. 12.

CONTRACTS AWARDED

Calif., Oakland—MACHINE SHOP—Art Tool & Die Wks., 1020 60th St., 1 story, 23 x 90 ft. brick, heavy mill, 60th St. near Idaho St., day labor.

N. Y., Elmira—FOUNDRY—Elmira Fdry. Co. (subsidiary General Electric Co., River Rd., Schenectady) 50 x 160 ft. foundry, to Lowman Constr. Co., 608 William St., Elmira. Est. $50,000.

N. Y., Tonawanda — FOUNDRY and MACHINE SHOP—Lake Erie Eng. Co., 268 Perry St., Buffalo, 1 story, 115 x 500 ft., brick, steel, to W. Cowper Co., Rand Bldg., Buffalo, $120,000. Noted Apr. 16.

POWER PLANTS

PROPOSED WORK

Colo., Grand Junction—City Council defeated $750,000, municipal power plant. Wood & Weber, 110 14th St., Denver, engrs. Noted Mar. 26.

N. Y., Brooklyn—Dpt. Hospitals, Municipal Bldg., New York, plans by L. P. Ward, 205 East 42nd St., New York, power generating plant, Clarkson and Albany Aves. $800,000.

N. Y., Watertown — Beebe Island Corp., G. Seymour Knowlton, pres., c/o Knowlton Bros. Paper Co., 213 Factory St., soon lets contract 10,000 hp. power plant. $600,000-$700,000. Noted Feb. 26.

O., Cleveland—Spencerian School, E. E. Merville, pres., 3201 Euclid Ave., 1 story, brick, steel, concrete heating plant, 3201 Euclid Ave. $40,000. Engineer and architect not selected.

Tex., Eagle Pass—Central Power & Light Co., National Bank of Commerce Bldg., San Antonio, plans by J. Marriott, National Bank of Commerce Bldg., San Antonio, 2 and 3 story power plant for lighting and power unit.

Tex., Galveston—City plans by Burns & McDonnell Eng. Co., engrs. and archts., Interstate Bldg., Kansas City, Mo., municipal electric plant, incl. power plant, boiler plant equipment, turbine room equipment, distribution system. $986,500.

BIDS ASKED

Ind., Lafayette — Purdue University, West Lafayette, taking bids rein.-con., brick power plant addition, on campus. $100,000. W. Scholer, 210 Wallace Bldg., archt.

Mich., Detroit—May 19, by Bd. Water Comrs., Water Bd. Bldg., 735 Randolph St., furnishing, installing complete power plant piping systems at Springwells Station Power Plant. G. H. Fenkell, genl. mgr. and ch. engr.; adv. E. N.-R. Apr. 23.

Va., Richmond—Carneal, Johnston & Wright, archts., Electric Bldg., taking bids 1 story, basement, 40 x 111 ft., brick power plant at St. Josephs Orphanage, at Hollybrook, near here.

CONTRACTS AWARDED

Ill., Chicago—Commonwealth Edison Co., 72 West Adams St., masonry contract for found., 7 story, 62 x 85 ft., brick, electric station, 1034-58 Western Ave., to Person Constr. Co., 100 North La Salle St. Est. $70,000. H. H. von Holst, 20 West Wacker Dr., archt.

N. H., Exeter — Exeter Hospital, Prospect Hill, 1 story, basement, 42 x 75 ft., brick, rein.-con. service building to house central heating plant, laundry, plain found., to I. H. Brown, North Hampton, $35,500. Noted Apr. 17.

WAREHOUSES

PROPOSED WORK

N. J., Perth Amboy—Ballinger & Co., archts., 12th and Chestnut Sts., Phila., Pa., general contract 1 story, basement, 260 x 460 irregular sized brick, steel warehouse, Fayette and Read Sts., for Greenspan Bros., 226 Washington St. $300,000. Project in abeyance. Noted Feb. 12.

N. Y., Buffalo—G. S. Rider, archt., Marshall Bldg., Cleveland, O., soon lets contract 3 story, basement, 100 x 140 ft., rein.-con. warehouse, Bailey and Clinton Sts., for Granger & Co., 135 Scott St. To exceed $100,000.

N. Y., Buffalo — G. S. Rider Co., archts., Marshall Bldg., Cleveland, O., soon lets contract 2 story, basement, 150 x 160 ft., rein.-con. warehouse, for S. N. Flickenger, 70 Perry St. To exceed $100,000.

O., Cleveland—Baltimore & Ohio R.R., H. A. Lane, ch. engr. system, Baltimore, Md., soon lets contract 1 and 2 story, 75 x 350 ft. brick, steel, concrete, 75 x 350 ft., freight house, Main and River Sts. $150,000.

Pa., Kittanning—See "Unclassified."

Pa., Pittsburgh — Duquesne Warehouse Co., 10th and Pennsylvania Sts., subsidiary Pennsylvania R.R. Co., plans by Hunting, Davis & Dunnells, Century Bldg., 10 story, basement, 18 story tower, 320 x 560 ft., concrete storage warehouse, incl. bus terminal, garage, 10th and Pennsylvania Sts., also tunnels under Duquesne Way to Allegheny River. $4,000,000.

BIDS ASKED

N. Y., New York—Randik Realty Co., 206 Lexington Ave., taking bids general contract altering and constructing storage, stores addition, 649 Lexington Ave. $150,000. B. H. Whinston, 6 East 46th St., archt. Noted Apr. 9.

CONTRACTS AWARDED

Ore., Portland—Union Pacific Ry. Co., G. J. Adamson, ch. engr., 15th and Dodge Sts., Ohaha, Neb., 2 story, 80 x 100 ft. warehouse, 60 Clark St., to Valvoline Oil Co., 335 East Washington St. Est. $50,000.

See proposal advertising on page 105